U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
PB80-158660

Local Land-Use and Landownership Patterns Near a Power Plant Wisconsin Power Plant Impact Study

Wisconsin Univ -Madison

Prepared for

Environmental Research Lab, Duluth, MN

Jan 80

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/3-80-021		PB80-158660

4. TITLE AND SUBTITLE	5. REPORT DATE
Local Land-use and Landownership Patterns Near a Power Plant-Wisconsin Power Plant Impact Study	January 1980 issuing date
	6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Michael Patrick Shaver and Philip Page	

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
Institute for Environmental Studies Environmental Monitoring and Data Acquisition Group University of Wisconsin-Madison Madison, Wisconsin 53706	1BA820
	11. CONTRACT/GRANT NO. R803971

12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
Environmental Research Laboratory - Duluth, MN Office of Research and Development U.S. Environmental Protection Agency Duluth, Minnesota 55804	Final; 11-69--4/75
	14. SPONSORING AGENCY CODE EPA/600/03

15. SUPPLEMENTARY NOTES

16. ABSTRACT

As a result of the construction of the Columbia Generating Station (Columbia I) near Portage, Wisconsin, the three sponsoring utility companies began making compensation payments in 1971 to the host township, Pacific Township, Columbia County. As specified by Wisconsin statutes, these payments are designed to compensate the township for property tax losses caused by the plant, for possible increased costs for social services, and for possible increased environmental degradation. Despite recent amendments to the statutes, these payments have created a "tax island" in Pacific Township; that is, the township no longer needs to levy any local property tax.

Property records and land-use maps indicate that by 1975 residential development had accelerated in the township, although no significant increase in commercial or industrial development was evident. The sharp upturn in the rate of residential growth contrasted with a continuous and moderate rate of growth in the adjacent township of Fort Winnebago. The change in Pacific Township was accompanied by decreases in the average size of individual property holdings and in the average size of individual property sales. No significant change was found in the proportion of absentee or corporate owners in the township.

These findings must be considered preliminary, since they are based only on the 4 years following the beginning of construction of the station, and since other factors may have contributed to the observed changes.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Land acquisition Land titles Land use Taxes	Wisconsin power plant study Columbia County, Wisconsin	43 A,B,F 70 F

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
	Unclassified	68
Release to public	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

* U.S. GOVERNMENT PRINTING OFFICE: 1980-657-146/5570

United States
Environmental Protection
Agency

Environmental Research
Laboratory
Duluth MN 55804

EPA-600/3-80-021
January 1980

Research and Development

PB80-158660

EPA

Local Land-Use and Landownership Patterns Near a Power Plant

Wisconsin Power Plant Impact Study

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

RESEARCH REPORTING SERIES

Research reports of the Office of Research and Development, U.S. Environmental Protection Agency, have been grouped into nine series. These nine broad categories were established to facilitate further development and application of environmental technology. Elimination of traditional grouping was consciously planned to foster technology transfer and a maximum interface in related fields. The nine series are:

1. Environmental Health Effects Research
2. Environmental Protection Technology
3. Ecological Research
4. Environmental Monitoring
5. Socioeconomic Environmental Studies
6. Scientific and Technical Assessment Reports (STAR)
7. Interagency Energy-Environment Research and Development
8. "Special" Reports
9. Miscellaneous Reports

This report has been assigned to the ECOLOGICAL RESEARCH series. This series describes research on the effects of pollution on humans, plant and animal species, and materials. Problems are assessed for their long- and short-term influences. Investigations include formation, transport, and pathway studies to determine the fate of pollutants and their effects. This work provides the technical basis for setting standards to minimize undesirable changes in living organisms in the aquatic, terrestrial, and atmospheric environments.

This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

EPA-600/3-80-021
January 1980

LOCAL LAND-USE AND LANDOWNERSHIP PATTERNS NEAR A POWER PLANT
Wisconsin Power Plant Impact Study

by

Michael Patrick Shaver
Philip Page
Institute for Environmental Studies
University of Wisconsin-Madison
Madison, Wisconsin 53706

Grant No. R803971

Project Officer

Gary E. Glass
Environmental Research Laboratory
Duluth, Minnesota 55804

This study was conducted in cooperation with

Wisconsin Power and Light Company,
Madison Gas and Electric Company,
Wisconsin Public Service Corporation,
Wisconsin Public Service Commission,
and Wisconsin Department of Natural Resources

ENVIRONMENTAL RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
DULUTH, MINNESOTA 55804

DISCLAIMER

This report has been reviewed by the Environmental Research Laboratory-Duluth, U.S. Environmental Protection Agency, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the U.S. Environmental Protection Agency, nor does mention of trade names on commercial products constitute endorsement or recommendation for use.

FOREWORD

As part of its role in guiding efforts to improve the environment, one function of the U.S. Environmental Protection Agency (EPA) is to sponsor system-wide research projects which encompass multiple facets of environmental impact. The ramifications of large construction or development projects are not confined, for example, to chemical or biological effects. The Agency, therefore, promotes research that transcends the boundaries of traditional disciplines, covers a broad range of investigations, and integrates the findings from these investigations.

One such project, which the EPA is supporting through its Environmental Research Laboratory in Duluth, Minnesota, is the study "The Impacts of Coal-Fired Power Plants on the Environment." This interdisciplinary study, involving investigators and experiments from many academic departments at the University of Wisconsin, is being carried out by the Environmental Monitoring and Data Acquisition Group of the Institute for Environmental Studies at the University of Wisconsin-Madison. Several utilities and state agencies are cooperating in the study: Wisconsin Power and Light Company, Madison Gas and Electric Company, Wisconsin Public Service Corporation, Wisconsin Public Service Commission, and the Wisconsin Department of Natural Resources.

During the next year reports from this study, which was based primarily at the Columbia Generating Station near Portage, Wisconsin, will be published as a series within the EPA Ecological Research Series. These reports will include topics related to chemical constituents, chemical transport mechanisms, biological effects, social and economic effects, and integration and synthesis.

One component of the Columbia impact study dealt with the potential economic effects on the host township of the tax advantages accruing to the township from direct utility payments. As this report demonstrates, preliminary results indicate that the elimination of property taxes in the township is leading to accelerated residential development.

J. David Yount
Acting Director
Environmental Research Laboratory-Duluth
Duluth, Minnesota

ABSTRACT

As a result of the construction of the Columbia Generating Station (Columbia I) near Portage, Wisconsin, the three sponsoring utility companies began making compensation payments in 1971 to the host township, Pacific Township, Columbia County. As specified by Wisconsin statutes, these payments are designed to compensate the township for property tax losses caused by the plant, for possible increased costs for social services, and for possible increased environmental degradation. Despite recent amendments to the statutes, these payments have created a "tax island" in Pacific Township; that is, the township no longer needs to levy any local property tax.

Property records and land-use maps indicate that by 1975 residential development had accelerated in the township, although no significant increase in commercial or industrial development was evident. The sharp upturn in the rate of residential growth contrasted with a continuous and moderate rate of growth in the adjacent township of Fort Winnebago. The change in Pacific Township was accompanied by decreases in the average size of individual property holdings and in the average size of individual property sales. No significant change was found in the proportion of absentee or corporate owners in the township.

These findings must be considered preliminary, since they are based only on the 4 yr following the beginning of construction of the station, and since other factors may have contributed to the observed changes.

The U.S. Environmental Protection Agency contributed directly to this study by providing funds for graphics and report production. The Agency contributed indirectly by supporting in part the project "The Impacts of Coal-Fired Power Plants on the Environment." Additional funds for the impact study came from the University of Wisconsin-Madison, Wisconsin Power and Light Company, Madison Gas and Electric Company, Wisconsin Public Service Corporation, and Wisconsin Public Service Commission. This report is submitted toward fulfillment of Grant No. R803971 by the Environmental Monitoring and Data Acquisition Group, Institute for Environmental Studies, University of Wisconsin-Madison, under the partial sponsorship of the U.S. Environmental Protection Agency. The report covers the period November 1969 to April 1975, and work was completed as of February 1979.

CONTENTS

Foreword iii
Abstract iv
Figures vi
Tables viii

1. Introduction 1
   The power plant and study area 1
   Hypotheses 1
2. Conclusions and Recommendations 6
3. Creation of a Tax Island in Pacific Township 8
   Previous Wisconsin studies of utility-tax distributions . . . 8
   History of utility-tax distribution in Wisconsin 12
   Impact of utility payments on the budget of Pacific Township 15
4. Research Methods 18
   Temporal limits 18
   Selection of a control area 19
   Land-use mapping 20
   Landownership mapping 21
   Collection of ownership and sales data 21
5. Presentation and Analysis of Data 23
   Land-use patterns 23
   Landownership patterns 28
   Changes in mean size of individual holdings 38
   Property transfer matrices 48
   Changes in mean size of property sales 48
6. Discussion 53

Bibliography 56

FIGURES

Number		Page
1	Map of Columbia County showing location of townships and Columbia Generating Station	2
2	Property values in millions of dollars for Pacific Township, Columbia County, Wisconsin, by categories of land use 1962-74	11
3	Utility-tax-distribution system in Wisconsin in 1974	14
4	Land-use map for Pacific Township, Columbia County, Wisconsin--1962	24
5	Land-use map for Pacific Township, Columbia County, Wisconsin--1968	25
6	Land-use map for Pacific Township, Columbia County, Wisconsin--1970	26
7	Land-use map for Pacific Township, Columbia County, Wisconsin--1975	27
8	Land-use map for Fort Winnebago Township, Columbia County, Wisconsin--1962	29
9	Land-use map for Fort Winnebago Township, Columbia County, Wisconsin--1968	30
10	Land-use map for Fort Winnebago Township, Columbia County, Wisconsin--1970	31
11	Land-use map for Fort Winnebago Township, Columbia County, Wisconsin--1975	32
12	Residential land use in Pacific and Fort Winnebago townships, Columbia County, Wisconsin--1962-1974	33
13	Landownership map for Pacific Township, Columbia County, Wisconsin--1962	34
14	Landownership map for Pacific Township, Columbia County, Wisconsin--1965	35

15 Landownership map for Pacific Township, Columbia County, Wisconsin--1968 36

16 Landownership map for Pacific Township, Columbia County, Wisconsin--1971 37

17 Landownership map for Pacific Township, Columbia County Wisconsin--1974 39

18 Percentage of land owned by four categories of owners in Pacific Township, Columbia County, Wisconsin--1962-74 40

19 Landownership map for Fort Winnebago Township, Columbia County, Wisconsin--1962 41

20 Landownership map for Fort Winnebago Township, Columbia County, Wisconsin--1965 42

21 Landownership map for Fort Winnebago Township, Columbia County, Wisconsin--1968 43

22 Landownership map for Fort Winnebago Township, Columbia County, Wisconsin--1971 44

23 Landownership map for Fort Winnebago Township, Columbia County, Wisconsin--1974 45

24 Percentage of land owned by four categories of owners in Fort Winnebago Township, Columbia County, Wisconsin--1962-74 46

25 Mean size of property holdings in Pacific and Fort Winnebago Townships, Columbia County, Wisconsin--1962-74 47

26 Mean size of property sales in Pacific and Fort Winnebago Townships, Columbia County, Wisconsin, for triennial periods from 1962 to 1973 51

TABLES

Number		Page
1	Number of Acres in Various Land-Use Categories for Five Townships in Columbia County, Wisconsin--1970	3
2	Actual and Estimated Tax Revenues and Town Investment Fund for Pacific Township, Columbia County, Wisconsin--1971-1980	16
3	Property-Transfer Matrices for Pacific Township Showing Number of Acres Transferred and Number of Property Sales Among Four Categories of Buyers and Sellers for Triennial Periods from 1962 to 1973	49
4	Property-Transfer Matrices for Fort Winnebago Township Showing Number of Acres Transferred and Number of Property Sales Among Four Categories of Buyers and Sellers for Triennial Periods from 1962 to 1973	50

SECTION 1

INTRODUCTION

THE POWER PLANT AND STUDY AREA

The Columbia Generating Station consists of two 527-MW coal-fired electrical generating units constructed near Portage, Wis., between 1971 and 1978. The physical site, on the flood plain of the Wisconsin River, consists of approximately 2,710 acres in Pacific and Dekorra Townships, Columbia County, Wis. (Figure 1). Features of the site include a cooling lake of 488 acres, a coal storage and main generating station of 271 acres, and an ashpit of 78 acres. The total area directly affected by construction has been estimated at 1,003 acres.

Except for a small portion of the cooling lake, the generating station lies entirely within Pacific Township. This township and Fort Winnebago Township, the control township for this study, are predominantly agricultural. Both townships have sizable and fairly comparable areas of woodland, wetland, and parks, primarily along the Wisconsin and Fox Rivers. Pacific Township has had a greater proportion of commercial development than Fort Winnebago Township; most of this development is located along U.S. Highways 51 and 16 south of Portage. Land-use acreages for these two townships and three other townships in Columbia County were determined in 1970 by the Columbia County Planning Department (Table 1).

HYPOTHESES

Under a complex set of Wiconsin statutes (see section 3), the host township for a generating station receives substantial tax distributions from the participating utilities. As a result of these distributions Pacific Township has become a "tax island" and needs to levy no property taxes. Although the effects of utility-tax disbursements on a region or entire state have been investigated, little attention has been given to the effect at the township level. The purpose of this study is to compare Pacific and Fort Winnebago Townships from 1962 to 1975 to determine if significant changes in land-use and landownership patterns have occurred in Pacific Township since 1971.

Specifically, we hypothesized that residential development would increase more rapidly in Pacific Township than in Fort Winnebago Township. Although many factors might contribute to such growth, the existence of a tax island tends to increase development because property taxes are assessed on the value of the land plus the value of improvements, and therefore the greatest advantage would accrue to owners of developed property. To a certain extent

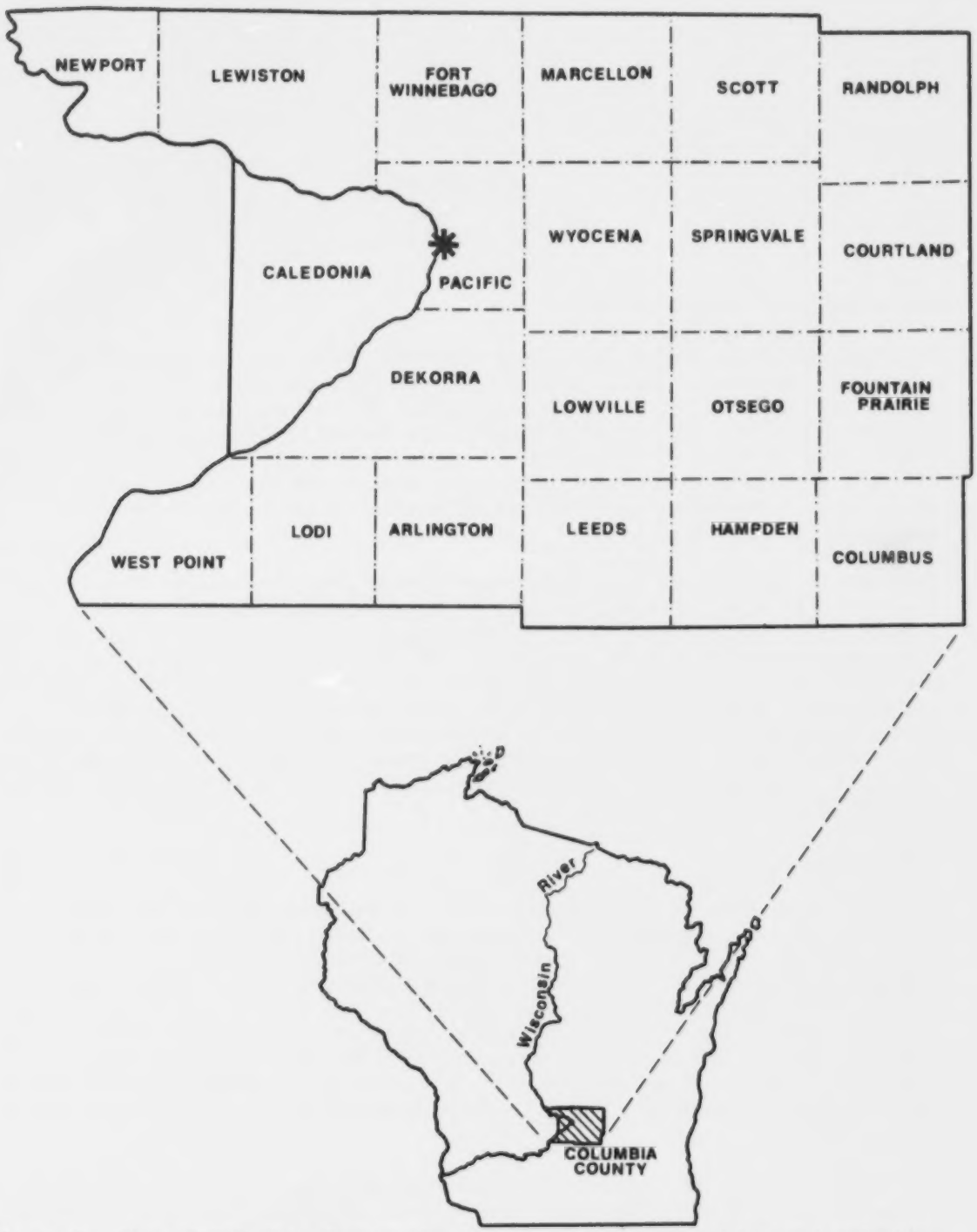

Figure 1. Map of Columbia County showing location of townships and Columbia Generating Station (✱).

TABLE 1. NUMBER OF ACRES IN VARIOUS LAND-USE CATEGORIES FOR FIVE TOWNSHIPS IN COLUMBIA COUNTY, WISCONSIN--1970[a]

Land-use category	Township				
	Marcellon	Newport	Otsego	Pacific	Ft. Winnegago
Crop and pasture lands	17,583.50	11,216.50	14,121.00	6,032.50	15,056.50
Special farms					
Woodlands	2,999.00	2,506.00	2,086.00	1,646.00	2,734.00
Wetlands	1,470.00	289.00	1,861.00	3,958.00	1,930.00
Water	84.85			366.63	1,117.87
One and two family residential	27.00	38.00	21.00	55.50	38.50
Multi-family					
Mobile homes and mobile home parks	8.00	8.00	7.50	63.00	6.50
Seasonal homes and laborers quarters	0.50	13.00		18.00	6.00
Farmsteads	785.00	390.00	810.00	180.00	610.00
General commercial	0.50	2.00	2.50	20.50	2.50
Highway retail	2.00	14.00		5.00	1.00
Hotel and motels		1.00			
Seasonal resorts		20.00		2.00	
Commercial recreation	1.50	16.00		39.00	
General industrial	1.00	3.00	19.00	40.00	
Warehouses		1.00		1.50	0.50
Refuse disposal sites		1.00	2.00	2.00	
Storage garage		1.00			
Extractive	10.00	13.00	20.00	203.00	7.00
Transportation, communication, and utilities	0.50			1.00	
Schools	2.00	1.00		1.00	1.00
Other institutional	4.00	57.50	3.00		16.00
Parks and open space	1.00	41.00	852.00	1,048.00	1,959.00
Cemeteries	6.00	10.00	29.00	1.00	
Total acreage	22,986.35	14,642.00	19,834.00	13,683.63	23,486.37

[a]From Columbia County, Wisconsin, Planning Department (1970c).

this tax advantage may be offset by its tendency to increase land prices in the township. The situation may be viewed through the eyes of the potential home or business owner seeking a location to develop. If other locational factors are assumed to be more or less equal, he will be drawn to the tax island. Even though the purchase price of land may be higher, the potential developer will still purchase and develop there as long as overall savings are to his advantage. In essence, the market and each individual property owner's desire to maximize his savings tend to accelerate the development of property to its highest category of potential use.

For the same reasons we also hypothesized that commercial and industrial development would increase in Pacific Township. This kind of development should be less evident in the first years of the existence of the tax island because such factors as markets, raw materials, transport networks, and labor sources might outweigh the tax advantage for many industries.

Several corollaries to these hypotheses were also explored. Changes in land use, we expected, might be reflected in changes in landownership. Specifically, since local capital and expertise might be inadequate to support the hypothesized development, we expected increases in absentee and corporate ownership of land. In addition, we hypothesized that increased residential or commercial development would be reflected in the reduced mean size of individual property holdings and in the reduced mean size of individual property sales, since such development usually involves the subdivision and sale of increasingly smaller parcels of land.

This study does not attempt to prove that the presence of the Columbia Generating Station has caused changes in land use in Pacific Township. Many additional factors could contribute significantly to such change, including the township's location between Portage and Madison, the presence of large quantities of marginal agricultural land in the township during a period of rising land prices, the immigration of new employees for the power plant, improved services in the township, and the unpredictable decisions of land developers and land buyers. Given the number of such potential factors, proof that the tax-island effect caused changes in land use in Pacific Township probably cannot be achieved and certainly lies outside the scope of this study. Instead, this report seeks to show that residential development increased rapidly in Pacific Township between 1971 and 1975 and that the power plant's tax-island effect may have created preconditions that encouraged this development.

The preliminary nature of the report is evident in the short duration of the assessment period and in the use of only one control township. Since time constraints required that 1975 be the end of the period under study, a limit that prevents full assessment of the influence of a power plant that was not begun until 1971, this report is intended instead to provide the basis for a follow-up study or for more complete assessments of comparable situations. In addition to the limited study period, more control areas near Pacific Township and similar examinations of other host townships would be required for a complete assessment of the tax-island effect. In this study we chose to examine in detail the property transactions and ownership records in Pacific Township and in one control township and to use those documents to construct a

series of detailed land-use and landownership maps of both townships. This very detailed process precluded our extending the analysis to additional control townships or host townships.

SECTION 2

CONCLUSIONS AND RECOMMENDATIONS

Land-use maps and data demonstrated that residential development increased in Pacific Township following construction of the Columbia Generating Station. Between 1970 and 1975 the total acreage of residential property in the township nearly doubled. The accelerated rate of development was discordant with the historical rate of development in the township and with the nearly constant rate of development in the control township (Fort Winnebago). Furthermore, the base for continued increases in residential development is evident in the planned but unsold residential parcels in new subdivisions.

The mean size of property holdings and the mean acreage of individual property sales were similar for the two townships from 1962 and 1970, but after 1970 both values declined significantly in Pacific Township, thus confirming the increase in residential development.

On the other hand, by 1975 no significant increases in commercial or industrial development were evident, nor were any significant changes in landownership categories apparent. The only major changes were the utilities' own acquisitions and increases in public holdings by the Wisconsin Department of Natural Resources.

Increased residential development in Pacific Township, where a tax-island effect was created by utility-tax payments, cannot be attributed solely to the tax-island effect. Many other factors may have contributed to the increased development. Although we cannot assert that the tax advantages necessarily induced land-use changes, the rapid increase in tax revenues appears to have established preconditions for increased residential growth.

Studies should be undertaken to delineate further the economic impacts of utility-tax distribution on local political units. This study of Pacific and Fort Winnebago Townships should be extended to assess possible changes in land use and landownership over a larger period of time. Other townships in Columbia County should be included as additional control areas. Similar studies should be conducted in areas near other power plants where tax islands have resulted and where tax distributions have not had as dramatic an effect on local public budgets. Since Wisconsin's utility-tax-distribution system was changed in 1975, studies should be made to determine the implications of the new law. Attempts should be made to determine the amount of compensation to which the host community is entitled and to test the efficiency with which the disbursement system provides compensation.

Researchers conducting further studies should consider other methods in addition to those used in this study. Tax-assessment records, which could not be obtained for this study, should be used if possible. A price series for land in the study area and inclusion of data on the value and type of new residences should be considered. Additional variables that may affect development, such as those listed in section 1, might be analyzed. To assess the relative importance of the tax-island effect, several control areas should be used.

SECTION 3

CREATION OF A TAX ISLAND IN PACIFIC TOWNSHIP

PREVIOUS WISCONSIN STUDIES OF UTILITY-TAX DISTRIBUTIONS

Changes in land-use and landownership patterns are usually addressed under the heading of "socio-economic impacts" in the environmental impact reports prepared for power plants. This format was used in the preparation of impact reports for Columbia Generating Stations I and II by the utility companies, the Wisconsin Department of Natural Resources (DNR), and the Wisconsin Public Service Commission (PSC). The technique used by all three agencies was to split the analysis temporarily into effects of actual construction activities and effects of postconstruction operations. Thus primary concern during the construction phase was focused on the influx of labor, capital, construction equipment, and related resources that might have an effect on the local socio-economic system. Potential effects examined for the postconstruction phase were generally restricted to increased demands for social services that might be anticipated from the actual facility and the operational labor force.

The draft environmental impact statement for the Columbia I unit prepared by the Wisconsin Department of Natural Resources (1973), concludes that "the probable impact of the Columbia Project on land-use patterns is not known at this time. The present trend in land-use in the vicinity of the project site appears to be toward commercial industrial development, although agriculture is still of primary importance." The report speculates on various effects on land-use patterns arising from the "possibility of damage to crops due to air pollution" and the "potential decline of residential property values with an accompanying increase in industrial property values." The report also acknowledges that "changes in tax structure will have an effect on the development patterns in this area," but declines any futher speculation on this aspect in deference to a planned study by the University of Wisconsin. This vague analysis is characteristic of early environmental impact statements, indicating the paucity of data on which to base credible predictions.

The impact study 2 yr later by Westwood Research Incorporated (1974), reflects a significantly improved and expanded methodology, partially facilitated by the unique wealth of pertinent data collected during construction of Columbia I. Armed with statistics for purchasing, employment, payrolls, housing demand, transportation, and other pertinent aspects, the authors of this study could make fairly reliable predictions regarding the short-term construction-related effects of Columbia II. This very detailed report is one of the most comprehensive of its kind. The Westwood report concludes that the "construction of Columbia Generating Station, Unit No. 2, will not cause any significant adverse changes in local population patterns or

local demand for housing and community services. No significant adverse changes in land-use patterns in the area will result from the construction needs for local building materials" and "no new land will be required and other land-uses will not be affected."

Although the analysis conducted by the Westwood study appears quite valid, the contextual framework of the research has deficiencies. The secondary effects arising from the influx of large utility-tax revenues, paid through the Wisconsin shared revenue account, are generally ignored. Although considerable space is devoted to estimating future local tax revenues, no attempt is made to assess the potential impact of these payments on the existing land-use patterns. In addition, the Westwood study attempts to focus its analysis on various impact areas: the immediate area, defined as the entire county; the intermediate area, defined as the seven contiguous counties; and the entire service area of the three sponsoring utilities, which includes more than half the State. Thus, highly localized effects, such as the sizable utility revenues paid to the host township, may be obscured when averaged over the entire county or a larger area. Likewise, secondary effects on land-use patterns may be considered insignificant when related to the entire county, but may be highly significant at the local township level.

The preliminary environmental report for Columbia II, prepared and circulated by the Wisconsin Public Service Commission (1974a), reflects heavy dependence on the Westwood report and lists socio-economic effects as "non-significant incremental impacts," concluding that "no significant changes in local population patterns from the immigration of the relatively small number of personnel is expected." Because of comments received during the review of the preliminary environmental report, however, the PSC included the following assessment in its final impact statement later the same year: "The Town of Pacific [Pacific Township] is a major recipient of the utility tax. This tax situation will, in all likelihood, increase local development" (Wisconsin Public Service Commission 1974b).

The Westwood report is also cited repeatedly in an excellent work by McMillan (1975) on the effects of power plants on communities. He states: "The major economic impact of a power development upon the municipality in which it is located is through the substantial tax benefits provided. In rural communities studied, these revenues meant substantial reduction and even elimination of local taxes supporting the municipal government." The report provides a detailed explanation and model for computing immediate and future revenue gains derived from the utility. The author takes into account the potential offsetting liabilities and costs that can accompany power-plant siting and clearly demonstrates that "utility taxes have amounted to tax bonanzas in some local governments" (McMillan 1975).

In the study entitled Impacts of Power Plant Siting, conducted by the Wisconsin Public Service Commission (1975a) for the Coastal Zone Management Development Program, the most significant economic impact is considered to be the "rapidly increasing size of incoming revenues of the utility tax payment portion of the shared tax formula." This PSC study, conducted concurrently with our research, represents "an attempt to develop a data base and indicators to allow the prediction of the probable economic and socio-economic

impacts of power plant construction and operation on local units of government." The study presents historical data for population, school enrollments, real property values, and annual local budget expenditures and receipts for eight power plant sites in Wisconsin. These data are then manipulated through the use of a computer model and standardized regression analysis techniques to identify preconstruction trends and quantify postconstruction effects. These effects are then correlated with different variables associated with power-plant siting, such as size and type of plant as well as size and location of the host community. The report clearly documents the sizable increases in utility-tax revenues and the concomitant reduction or complete elimination of local tax collections in nearly every instance. With large nuclear plants, utility-tax revenue increases in excess of $3 million were observed during the period immediately following construction. The widespread occurrence of this fiscal phenomenon, termed a tax island, was also identified in the Tarr report on local government finance and organization (Tarr 1969).

The draft PSC report speculates on potential impacts stemming from the tax-island phenomenon, stating that "the elimination of the general property tax, in turn, will encourage land speculation and can be expected to have multiplier effects on the demand for land in the area, tending to drive up the full market value of such property. This [tax advantage], in turn, may be expected to induce construction of new housing developments and/or act as an incentive for in-migration of other industries attracted to the low tax base area" (Wisconsin Public Service Commission 1975a). Although the PSC study did not include adequate data to document the hypothetical residential and commercial development that it predicted, it did succeed in detecting the sudden increase in the rate of appreciation of local property values that occurred simultaneously with power-plant construction. Figure 2, based on property-assessment data reported by the PSC for the local area surrounding the Columbia station (Pacific Township), shows well this increase in value. Unfortunately, these data aggregate real estate property assessments, which include both the value of the land and the value of all improvments on the land. Thus, it is not possible to determine if the changes reflect an increase in the market value of the land, an increase in the degree of improvement (development) associated with the property, or, possibly, some combination of both. Without a more detailed analysis of the local situation and dynamics, this relationship between local property values and the siting of the power plant can only be considered tentative.

In summary, although some attempt has been made to identify utility-induced effects on land-use patterns, little attention has been given to potential effects on landownership patterns. The previous Wisconsin documents, addressing changes in land-use patterns, are further limited in that they do not devote adequate attention to very localized impacts, nor do they assess secondary effects arising from the influx of utility revenues. However, the influx of utility revenues is clearly established as a significant effect itself. The potential utility-induced changes in land-use and landownership patterns, hypothesized by the PSC study, may have some logical basis in theory, but such changes remain untested. Therefore, the objective of this study is to examine and test these hypotheses through

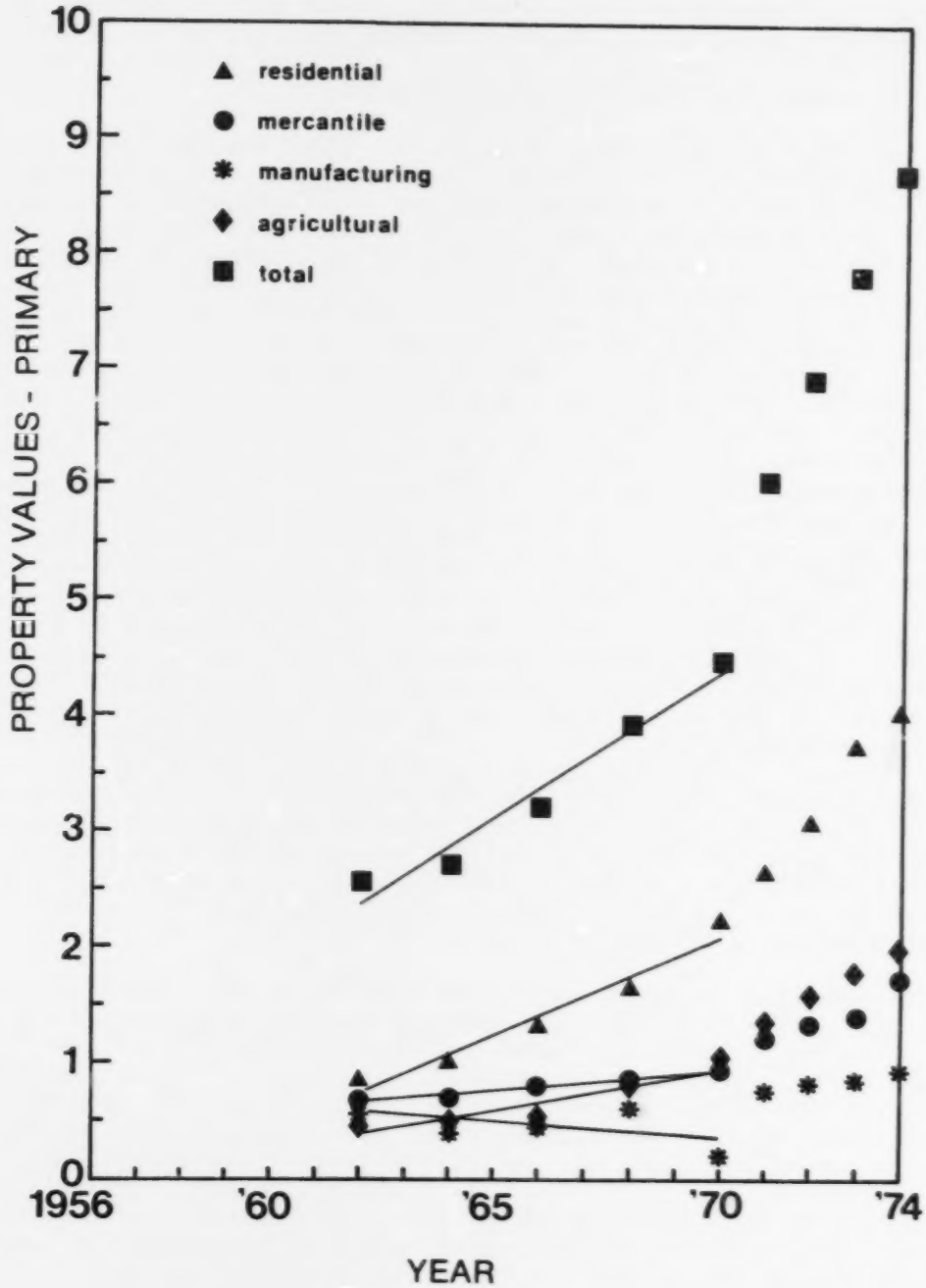

Figure 2. Property values in millions of dollars for Pacific Township, Columbia County, Wisconsin, by categories of land use--1962-74. Data from Wisconsin Department of Revenue (1975).

historical and comparative analyses of the land-use and landownership patterns of a specific host community, Pacific Township, Columbia County, Wisconsin.

HISTORY OF UTILITY-TAX DISTRIBUTION IN WISCONSIN

The Wisconsin Legislative Reference Bureau (1973) has compiled a detailed history of Wisconsin statutes governing the collection and disbursement of public utility taxes. Local taxation of public utility property was abolished in 1854 when the State instituted a policy of taxing all utilities on the basis of their gross earnings. In 1908 the State expanded the ad valorem property tax system to include all public utilities. In essence, the State levied on all utilities a tax based on the value of the individual utility's property within the State and the average net mill rate computed for all the tax districts within the State. Under this system the State retained 15% of the utility tax and disbursed the remainder to local units of government in proportion to the individual utility sales transacted in each municipality. Thus, urban areas, which consumed much larger amounts of electricity, received disproportionately large shares of the rebate. The location of the generating station was not considered. This inequity was partially alleviated in 1911, when the State developed a more complex formula for apportioning the rebate. The new formula took into account the location of the utility's property as well as the location of its sales. In 1917 the State reduced the total municipal apportionment to provide 20% of the total utility tax to individual counties. The county share was allocated in proportion to the amounts distributed to their respective municipalities. In 1916 the Wisconsin Supreme Court ruled that the apportionment formula was still inequitable, in that it gave disproportionate weight to the location of sales and, therefore, to urban areas. The apportionment formula was changed to comply with the court ruling and has, henceforth, been based primarily on the actual location of property, although the location of sales has still been included as a minor criterion. In 1963 the distribution was fixed at 17% for the State, 19.5% for the counties, and 63.5% for the municipalities. The actual apportionment formula remained intact, still based primarily on the location of the utility's property (Wisconsin Legislative Reference Bureau 1973).

The next major change of the system occurred in 1971, following the publication of the Tarr report and widespread citizen criticism of the utility-induced "tax islands," which were well documented in the report. Although the method by which the State taxed privately owned utilities did not change, the 1971 statutes reorganized the distribution system completely. All utility taxes, except 6.7% retained by the State, were now deposited in the municipal and county shared tax account. A special utility tax payment, based solely on the location and value of each utility's property, was made from this account prior to any other disbursements of these funds. The computation of these payments was based on a complex formula that attempted to compensate each community on the basis of its population, location, and wealth, as well as on the size and value of the utility property. The general thrust of the 1971 legislation was to substantially reduce the sizable revenues being realized by small local governments (McMillan 1975). The new laws, however, applied primarily to new plants and generally permitted communities containing existing plants, or plants under construction, to make a gradual transition to the new system and to reduced payments. In addition, host communities of

future plants were permitted to utilize the old disbursement formulas for the first 4 yr following the initiation of construction to "offset the loss of local property (during construction) before shared taxes could adequately compensate" (McMillan 1975). The PSC report also noted that "the primary goal of the revised distribution formula (1971 statutes) was to reduce the size and number of these 'tax islands', which would inevitably develop around any sizable power-generating facility." However, that same report pointed out in another section that "although the shared tax distribution was changed in 1971 to reduce the 'tax island' effects created by the inflow of such sizable sums, the size, and hence value, of electrical generating facilities has been increasing at a rapid rate in recent years, resulting in the sums of two or even three million dollars being returned annually to the host communities of the newer power facilities." The 1971 statutes did reduce the relative rates by which utility revenue payments were computed, but, since the new statutes failed to establish any absolute maximum limits on these payments, the rapidly escalating size and value of new plants, such as Columbia I and II, were sufficient to negate any reduction of the large payments previously identified. The utility-tax-distribution system, as it existed in 1974, is represented in Figure 3. The schema depicts the system in general, but not necessarily its actual application to any specific plant.

In 1975 the Wisconsin legislature acted to rectify the problem of excessive payments. These changes again reduced the rates by which utility revenue payments were computed and provided absolute maximum limits for all future plants. The legislation, however, contained several escape clauses that might permit local community payments to exceed these limits (Alden Hayes, personal communication). The law, like previous laws, permitted communities receiving payments based on previously existing plants to make the transition to the new system very gradually. The new payment limits were still liberal and might permit annual payments of $1 million to local municipalities hosting several utility plants.

A recent PSC report indicates that the primary function of the special utility payment to host municipalities is to provide just compensation for the reduction in local revenues resulting from the removal of utility property from the local tax base (Wisconsin Public Service Commission 1975b). The report also identifies secondary bases for compensation arising out of increased costs for social services and the loss of potential local revenues that might have been generated through alternate industrial development. The initial loss of revenues, resulting from conversion of the property to utility ownership, is fairly easy to calculate, but the secondary claims for compensation are more difficult to quantify. Changes in the demand for local social services are dependent on numerous variables relating to the plant and the local community. Claims to compensation for revenues that might be realized from alternate development must make very speculative assumptions about the nature and probability of such alternate development. The PSC report also acknowledges the recent addition of another basis for compensation: the burden of increased environmental degradation borne by the host community. This claim is perhaps the most difficult of all to quantify since the calculations require not only an accurate assessment of environmental impact, but also a clear delineation between the site-specific local effects and the wider ranging effects borne by the general public.

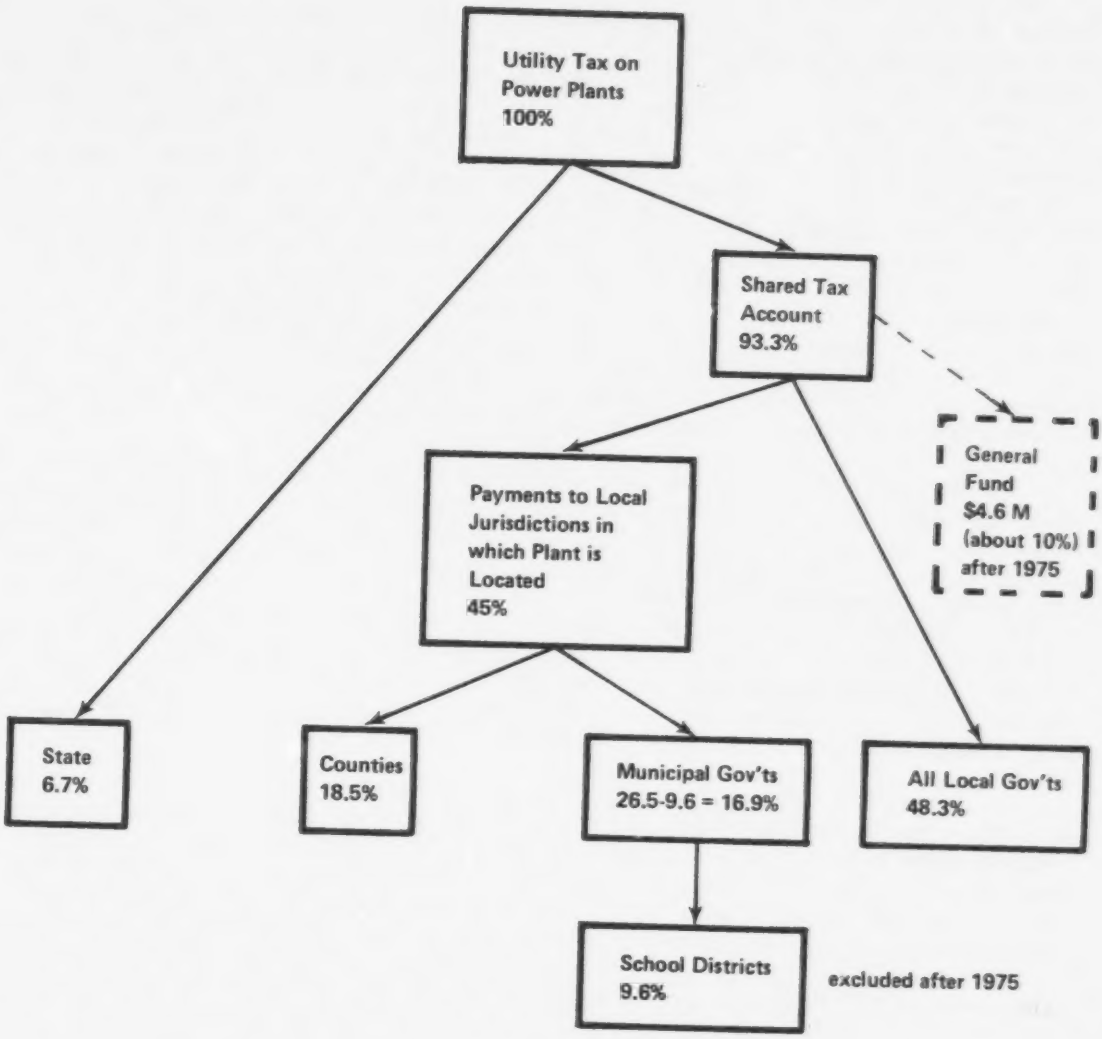
Utility Tax on Power Plants 100%
Shared Tax Account 93.3%
General Fund $4.6 M (about 10%) after 1975
Payments to Local Jurisdictions in which Plant is Located 45%
State 6.7%
Counties 18.5%
Municipal Gov'ts 26.5-9.6 = 16.9%
All Local Gov'ts 48.3%
School Districts 9.6%
excluded after 1975

Figure 3. Utility-tax-distribution system in Wisconsin in 1974.

An additional aspect to consider is the effect that annual utility payments may have on other local revenues provided by the State. Incorporation of the utility taxes into the shared revenue account in 1971 has made the special utility payment part of an interlocking system of revenue disbursements managed by the Wisconsin Departments of Revenue and Administration. Distribution of the shared revenue account funds to counties and municipalities is made through three annual payments: the per capita payment, the special utility payment, and the property tax burden payment. The per capita payment is based solely on population and is not affected by the special utility payment. The property tax burden payment, however, is computed according to a complex formula which takes into account both population and the local tax burden, as measured partially by a municipality's previous tax rates. Thus, a municipality that maintains a relatively low local tax rate can expect eventual reduction or possible elimination of this payment. This reduction may be of significance in instances involving utility-induced tax islands (Wisconsin State Statutes, Chapter 79, 1974).

The Property Tax Credit Program, which provides for payments to each municipality in the form of tax credits, is included in the same statute. Payments are based on a formula that takes into account the full value of all property within the municipality and its previous year's full value tax rate. The system, designed to equalize property tax burdens throughout the State, will generally operate to withhold credits from those communities with already low tax rates, while providing some assistance to areas where high tax rates have persisted. Communities that have eliminated their local tax collection would obviously forfeit any tax credits.

This abbreviated history of utility-tax disbursements must also include the issue of sharing municipal utility revenues with local school districts. A law enacted in 1925 directed all townships and villages to distribute one-half of their utility-tax receipts to local school districts within their own boundaries. The sharing-distribution rate was changed in 1971 to a 4-to-11 ratio of the total utility-tax receipts. However, an exception in the original law stipulated that municipalities were not required to share with school districts lying within counties whose populations exceed 50,000 or with school districts wholly encompassing a city. These provisions have frequently permitted municipalities to avoid sharing with the school districts. Such has been the case in the Pacific Township, which lies largely within the same school district as the city of Portage. The 1975 amendments to Chapter 79 of the Wisconsin State Statutes eliminate all requirements for the sharing of utility revenues with school districts, obviating any necessity for future consideration of this effect.

IMPACT OF UTILITY PAYMENTS ON THE BUDGET OF PACIFIC TOWNSHIP

With the previous discussion in mind, the impact of the Columbia Generating Station on the public economy and fiscal status of Pacific Township can be assessed. Utility-tax revenues paid to Pacific Township grew rapidly after the initiation of construction of the generating station in 1971 (Table 2). The town excess funds also have grown rapidly and have been invested in certified deposits earning between 5.5% and 6.5% annual interest. All data prior to 1975 were extracted from the Official Financial Reports of Pacific

Township, filed with the Wisconsin Department of Revenue. The utility revenues estimated for 1976 and later are based on the July 1975 amendments to Chapters 76 and 79 of the Wisconsin State Statutes. These projections were also discussed with a senior member of the Utility Tax Division, Department of Revenue, who agreed that they are reasonable and conservative estimates. Future tax levies were projected on the basis of an assumed annual growth rate of 6%. The projected growth of Pacific Township's investment fund was computed by assuming that the difference in the utility tax revenues and the total tax levy would be invested as it has been in the past. This is, of course, a simplification, since the township must also provide for its own operating expenses, which are normally included in the local tax collection. Pacific Townships's local budget has ranged from about $15,000 in 1970 to $21,000 in 1974. During the same period other revenue receipts from sources such as the State and county highway funds, federal revenue sharing, per capita shared revenue payments, and interest on the investment fund increased from about $35,000 in 1970 to about $60,000 in 1974. Thus, the local operating budget is more than adequately financed without the utility revenues. In fact, if growth in the investment fund occurs as projected, the annual interest payments from these investments will exceed the township's annual total tax levy by 1980.

TABLE 2. ACTUAL AND ESTIMATED TAX REVENUES AND TOWN INVESTMENT FUND FOR PACIFIC TOWNSHIP, COLUMBIA COUNTY, WISCONSIN--1971-1980

Year	Utility-tax revenue (including make-up)	Tax levey (State, county, school)	Local property tax collection	Township investment fund (annual interest not included)
1971	$19,935	$176,176	$154,635	$50,958
1972	59,937	184,903	154,720	81,922
1973	388,969	201,046	25,283	320,000
1974	1,171,344	201,735	0	1,311,902
1975	752,248	213,000[a]	0[a]	1,851,000[a]
1976	745,014[a]	226,000[a]	0[a]	2,470,000[a]
1977	725,000[a]	239,000[a]	0[a]	2,956,000[a]
1978	700,000[a]	253,000[a]	0[a]	3,403,000[a]
1979	675,000[a]	268,000[a]	0[a]	3,810,000[a]
1980	650,000[a]	284,000[a]	0[a]	4,176,000[a]

[a]Estimated projections based on current data and trends.

The intent here has not been to conduct a detailed and itemized economic analysis, but simply to assess the likelihood of the township's persistence as a tax island. The data overwhelmingly support such an assumption and further suggest that the township could maintain this status even in the face of extraordinarily large increases in local operating expenses or sizable reductions in other revenues.

This economic analysis is restricted to one specific instance in space and time. Although Columbia I was not affected by the 1975 amendments to the Wisconsin utility-tax distribution system, future power plants will be so affected. Moreover, other host communities, particularly in urban areas, will experience different economic effects. The simplified technique employed here for assessing the impact of a power plant on the local public economy does, however, seem applicable to most situations.

SECTION 4

RESEARCH METHODS

Two problems emerged at the outset of this investigation: What temporal bounds should be chosen and what area should be used as a control. The study of land-use and landownership patterns is particularly complex because these patterns are constantly changing in response to the pressures of the natural and human communities that create them and because the extremely diverse forces that affect the patterns, the variables of the experiment, cannot be manipulated or controlled.

TEMPORAL LIMITS

To document preconstruction land-use and landownership patterns, 1962 was selected as the starting point of the analysis period. Selection of this starting date permitted us to take advantage of existing aerial photography for 1962 and 1968.

The choice of a starting date for the hypothesized development resulting from the power plant was more difficult. We chose November 1969, the date of the public announcement that the plant would be built in Pacific Township. Some utility-induced land speculation could have occurred before that date, since the utilities purchased most of the land at the site during the late 1950's and since rumors of impending plant construction had circulated as early as 1965 (Schmeid 1973). However, in view of the vagaries of power-plant siting, the tentative nature of the rumors, and the high risks associated with speculative purchasing, significant speculation or development before 1969 is unlikely.

The analysis period was extended to July 1975, as far forward as the practical constraints of the project would permit. Although we hypothesized that some accelerated development would occur between 1969 and 1975, this assessment period is admittedly too brief to provide a complete documentation of the total expected changes. We expected that development would proceed slowly at first, especially since construction of the plant did not begin until 1971 and since the township did not receive its first large utility payment until November 1973. Preliminary visits to the area in the spring of 1975 confirmed the existence of new development and the local perception that accelerated development was occurring. Since the tax-sheltered status of the town is now well established, the potential change or rate of change identified by this study may accelerate. We anticipate, then, that a follow-up study will be performed to measure changes over a longer period.

SELECTION OF A CONTROL AREA

The selection of a control area was difficult. The entire series of resource evaluation reports prepared by the Columbia County, Wisconsin, Planning Department (1970a-f, 1971) was reviewed to identify similar areas. A dominant factor was the necessity of duplicating Pacific Township's location adjacent to Portage. Fort Winnebago Township was identified as the only municipality in the county which satisfied the basic criteria. The extent and distribution of natural resources in the two townships are quite similar. Similarities extend to soils, relief, drainage, wetland, public land, transportation networks, population growth, agricultural systems, recreational development, ethnic groups, and many other characteristics. Both townships lie adjacent to Portage and have experienced some expansion pressures from that source.

Some obvious dissimilarities must be acknowledged. Pacific is a small township, encompassing only about 13,000 acres, whereas Fort Winnebago includes about 20,000 acres. The difference can be compensated for by standardizing data or by concentrating the analysis on relative proportions. Although both townships presently have similar proportions of public property, Pacific's public acreage was not purchased until 1965-68. The public areas in both townships are wetland preserves with no recreational development. Although the two townships include comparable areas of wetland, the proportion in Pacific is much greater, and Pacific's proportion of agricultural land is much smaller. This imbalance is evident in the land-use data (Table 1) and will be further illustrated in a series of maps (section 5). Although Pacific Township has historically been more developed than Fort Winnebago, the difference between the two townships in the relative proportions of developed property has not been excessive (Table 1). Furthermore, since this study is primarily concerned with the rate of development, the initial inequality should not distort the analysis.

In addition to these natural and recognized dissimilarities, a potentially disruptive variable, zoning restrictions, was discovered midway through the data collection. Columbia County passed its initial zoning ordinance in 1961 and revised it in 1969 and 1973. Land within a township is not subject to zoning restrictions, however, unless the township votes to adopt the ordinance. Pacific has never approved the ordinance and therefore remains unzoned (Deknatel and Harris 1970), but Fort Winnebago did ratify the ordinance and has been zoned since 1965. The absence of zoning restrictions in an area surrounded by strictly zoned properties might induce development in the unzoned area and thus might prejudice the results of this study. However, three factors virtually eliminate the impact of the zoning differential on land-use patterns in Pacific. First, the major thrust of the Columbia County zoning ordinance has been "the protection of areas having prime agricultural soils" (Deknatel and Harris 1970), but the soils in Pacific Township are rated quite low in terms of agricultural productivity and therefore little or nothing of the area would be subject on this count to the zoning restriction. Second, although Pacific Township is exempted from the zoning ordinance, it is subject to the county flood plain ordinance and the county subdivision ordinance (Columbia County Statutes, Chapters 11 and 15, 1975). Compliance with these ordinances requires developers to conduct the same types of surveys

and to file the same applications as are required by the zoning ordinance. Finally, the Columbia County zoning ordinance is not comprehensive by any standards. If sufficient economic pressures are brought to bear, rezoning petitions will be approved. The effect of the county zoning ordinance has been to control development, not to prevent or inhibit it (Deknatel and Harris 1970). Thus, although creation of a zoning island may affect land-use patterns in general, the specific occurrence of this phenomenon in Pacific has had little or no such effect.

LAND-USE MAPPING

One problem in any land-use mapping project is the selection of categories. Selection is determined by the nature of the area to be mapped and the purpose for which the maps are to be used. The categories of interest, identified in the hypotheses of this study, included residential, commercial, and industrial. Since no heavy industry was located within either of the areas, and since sand and gravel pits are plentiful throughout the area, we decided to substitute manufacturing and extraction for the industrial category. Additional categories of agriculture, swamp-waste and wild pasture, forests and woodlands, and lakes and rivers were added to make the maps more comprehensive. These categories were compatible with the land-use categories utilized by the Columbia County Planning Department and are essentially the same as those established by the Wisconsin Department of Revenue for the purposes of property-tax assessment. We initially planned to use tax-assessment records to compile a portion of the land-use records, and, although these records could not be obtained, the land-use categories were retained in the hope that future researchers might be able to exploit this technique.

Historical land-use mapping for 1962 and 1968 was accomplished from black-and-white aerial photographs provided by the Columbia County Office of the Agricultural Stabilization and Conservation Service. The aerial photos have been enlarged to a scale of 1:8,000, and section lines and identification have been superimposed to facilitate use. Each enlarged photograph contains four standard survey sections. The 1970 land-use data were obtained from the Columbia County Planning Department, which had compiled township land-use maps from a 1970 field survey. These maps, of both the test and the control townships, were copied to provide the historical record for 1970. Final land-use coverage was obtained by field survey during July 1975. Thus, the historical record of land-use is based on four discrete sampling periods: 1962, 1968, 1970, and 1975.

The large scale (1:24,000) blank zoning maps, which were used as base maps, were provided by the Columbia County Planning Department and were originally compiled by the Wisconsin Bureau of Local and Regional Planning, Department of Local Affairs and Development. Transfer of data was frequently facilitated by the regular patterns of the original land survey. A modified zoom-transfer scope was used to reduce scale and to project irregular photographic patterns. Consistency of delineation in arbitrary vegetation categories was maintained by overlaying successive maps on a light table during photographic analysis, so that only intentional temporal differences were reflected in the resultant patterns. Even with this procedure, however,

delineation between the category of swamp-waste and wild pasture and the category of forests and woodlands became somewhat arbitrary. Agricultural lands (including cropped land and cultivated pasture) were readily delineated in many cases because most of the photographs had been marked and indexed to show the actual crop identity and field ownership. The category forests and woodlands included tree farms and nurseries, in addition to wild forest land. Farmsteads were included in the agricultural category. Mapping and computation of residential property was facilitated by reference to master plat maps and subdivision plats, maintained in the Columbia County Tax Listing Office. Entire residential subdivisions and additions were entered on the maps as of the date of official platting, regardless of the stage of development at that time. Manufacturing and extraction included the sand and gravel pits, which constitute a major portion of that category.

LANDOWNERSHIP MAPPING

Selection of categories for landownership mapping was based primarily on the hypotheses of the study, which predicted changes in the relative proportions of property in the categories of local ownership, absentee ownership, and corporate ownership. A fourth category of public ownership was added to account for additional areas that were detected during data collection.

Compilation of historical landownership maps began with the extraction of ownership data from annual township tax rolls, maintained by the Columbia County Treasurer's Office. Data were extracted for 1962, 1965, 1968, 1971, and 1974 since those years coincided with the land-use maps and with the tri-annual plat map series published by the Rockford Map Publishing Company (1961,1965, 1968, 1972, 1974). Ownership lists, reflecting names, parcel numbers, acreage, and the category of ownership, were compiled for both townships. The local-private category was assigned to all owners whose addresses lay within the study area or any of the surrounding contiguous townships or other municipalities. Private owners outside that area were classified as absentee. Acreage figures, which were occasionally missing from the tax rolls, were extracted later from the master plat maps in the Tax Listing Office. The ownership mapping was accomplished by the use of ownership lists in conjunction with the master plat maps, which describe and delineate individual numbered parcels. The same blank zoning maps that were used to compile the land-use maps were used as the base maps for the landownership data.

COLLECTION OF OWNERSHIP AND SALES DATA

The compilation of property sales data was facilitated by the existence of a transfer extract, maintained in the Tax Listing Office for each township in the county. This extract, used by the Tax Listing Office to maintain accurate identification of property owners, is derived from the official records maintained in the Office of the County Registrar of Deeds. Entries for date, seller, buyer, parcel numbers, and acreage were extracted. Then, by reference to the previously compiled ownership lists, the seller and buyer were further identified by ownership category. This information on the nature of the transfer was recorded along with the sale entry. These data provide an

excellent cross-check on changes noted on the landownership maps from year to year.

SECTION 5

PRESENTATION AND ANALYSIS OF DATA

LAND-USE PATTERNS

Little change in the various land-use categories can be detected in the maps for Pacific Township for 1962, 1968, and 1970 (Figure 4, Figure 5, and Figure 6). The residential category increased approximately 20 acres during the 1962-68 period. The rate of residential development increased only slightly during the 1968-70 period, and much of that increase was due to the labor force engaged in construction of the generating station. Prior to 1970 the manufacturing and extraction category and the commercial category remained almost stable, except for the 1965 addition of the commercially operated Lake George Recreation Area.

The 1975 map (Figure 7), representing postconstruction land-use patterns, reflects significant changes in the various categories and in the historical rates of change. In the residential category three platted subdivisions in sections 14, 15, and 22 and two smaller unplatted additions in sections 12 and 13 composed most of the growth. We estimated the total area converted to residential use during the 1970-75 period as 158 acres. Such residential growth is significant when compared to the total of 60 acres of residential property added during the 1962-70 period. In fact, the total acreage of residential property nearly doubled between 1970 and 1975.

Aside from the addition of the power plant itself, the category of manufacturing and extraction did not change during the postconstruction period. Several small additions to the commercial category can be detected on the 1975 map. These additions, lying primarily along Highway 16, are warehouses and storage yards. Their inclusion in the commercial category is largely offset by the elimination of the large junk yard which was previously located along Highway 51 in section 27, and which was moved out of the area in 1971 when the property was acquired for construction of the generating station. Thus, the total area in the commercial category did not change significantly.

The sequential land-use maps for Fort Winnebago Township in the preconstruction period (1962, 1968, and 1970; Figure 8, Figure 9, and Figure 10) reveal a gradual increase in property categorized as residential. The change is most evident in the expansion of the Redbird Estates Subdivision in section 34 and in the growth of a second home development in section 16. The successive maps also indicate the scattered addition of isolated residential lots. The rate of increase in residential acreage between 1962 and 1970 was at 5 acres per year for Fort Winnebago, whereas for the same years in Pacific

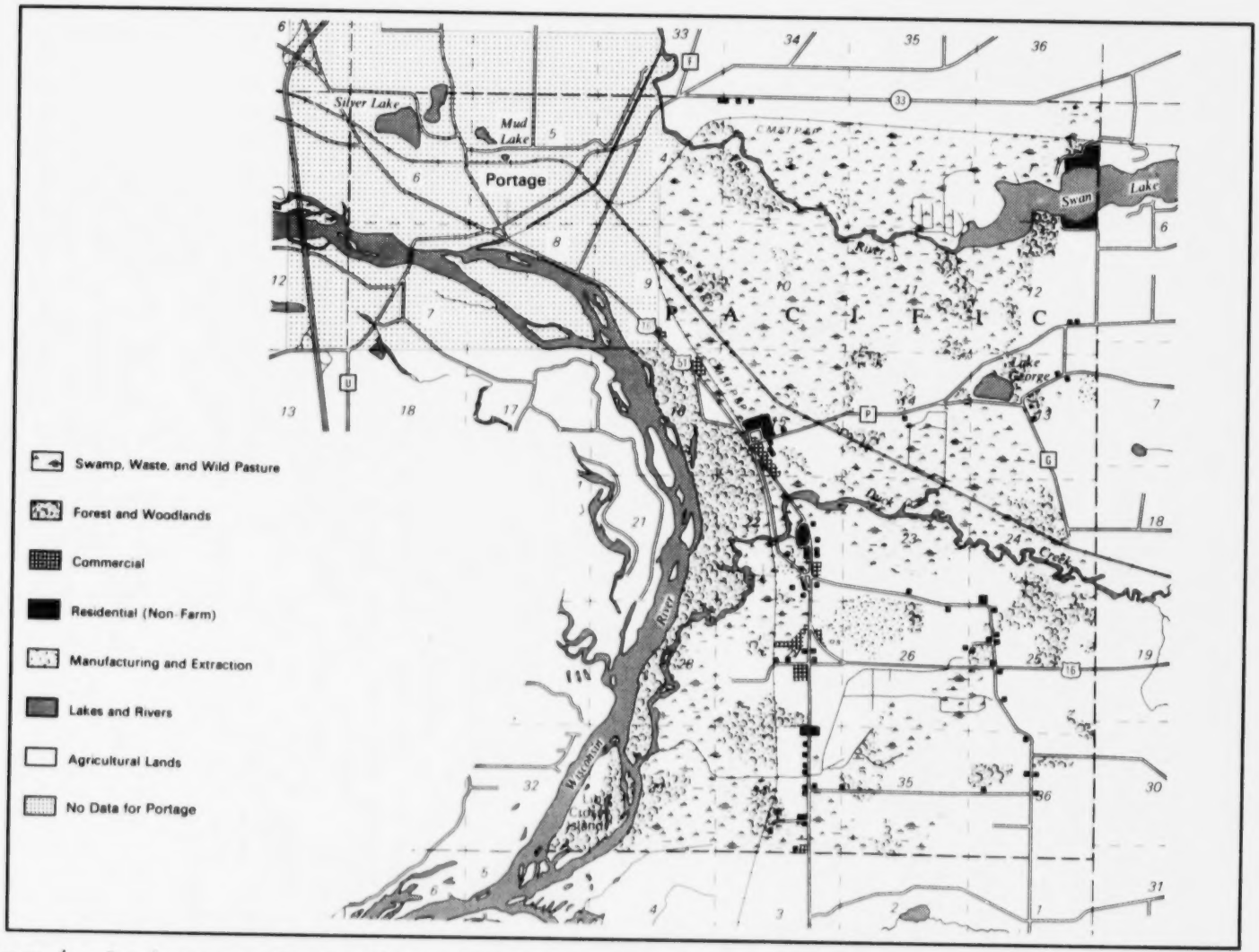

Figure 4. Land-use map for Pacific Township, Columbia County, Wisconsin--1962.

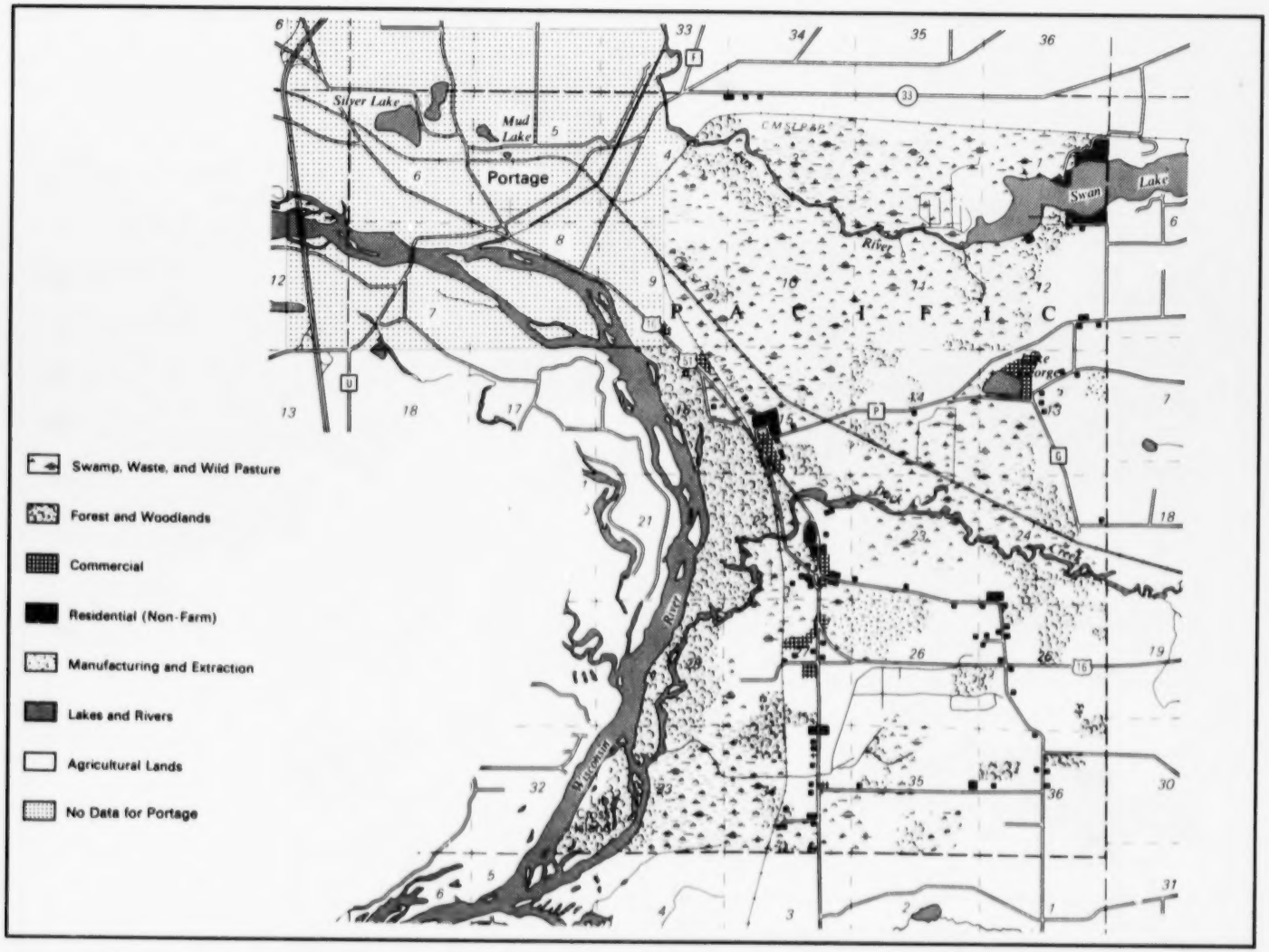

Figure 5. Land-use map for Pacific Township, Columbia County, Wisconsin--1968.

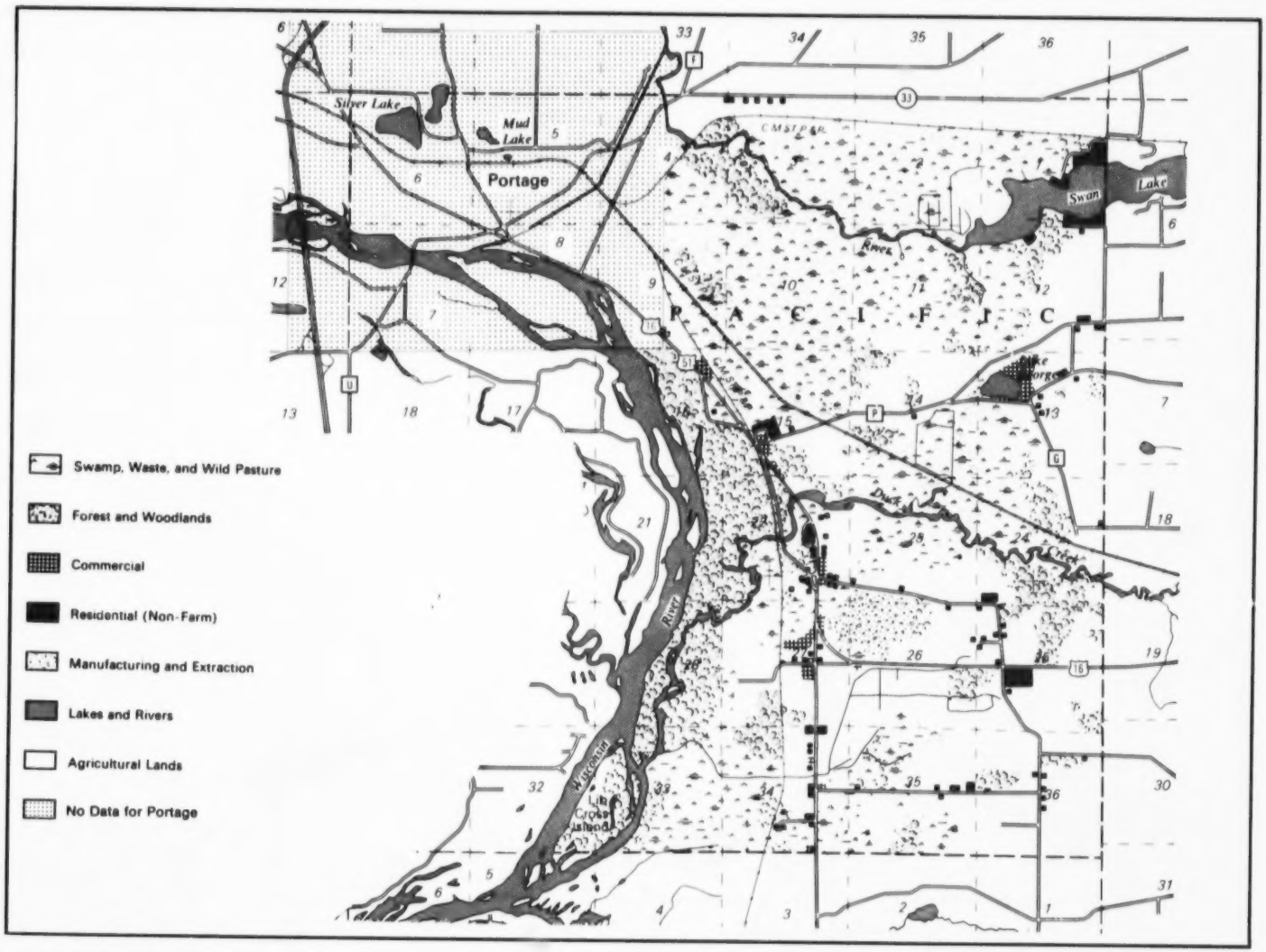

Figure 6. Land-use map for Pacific Township, Columbia County, Wisconsin--1970.

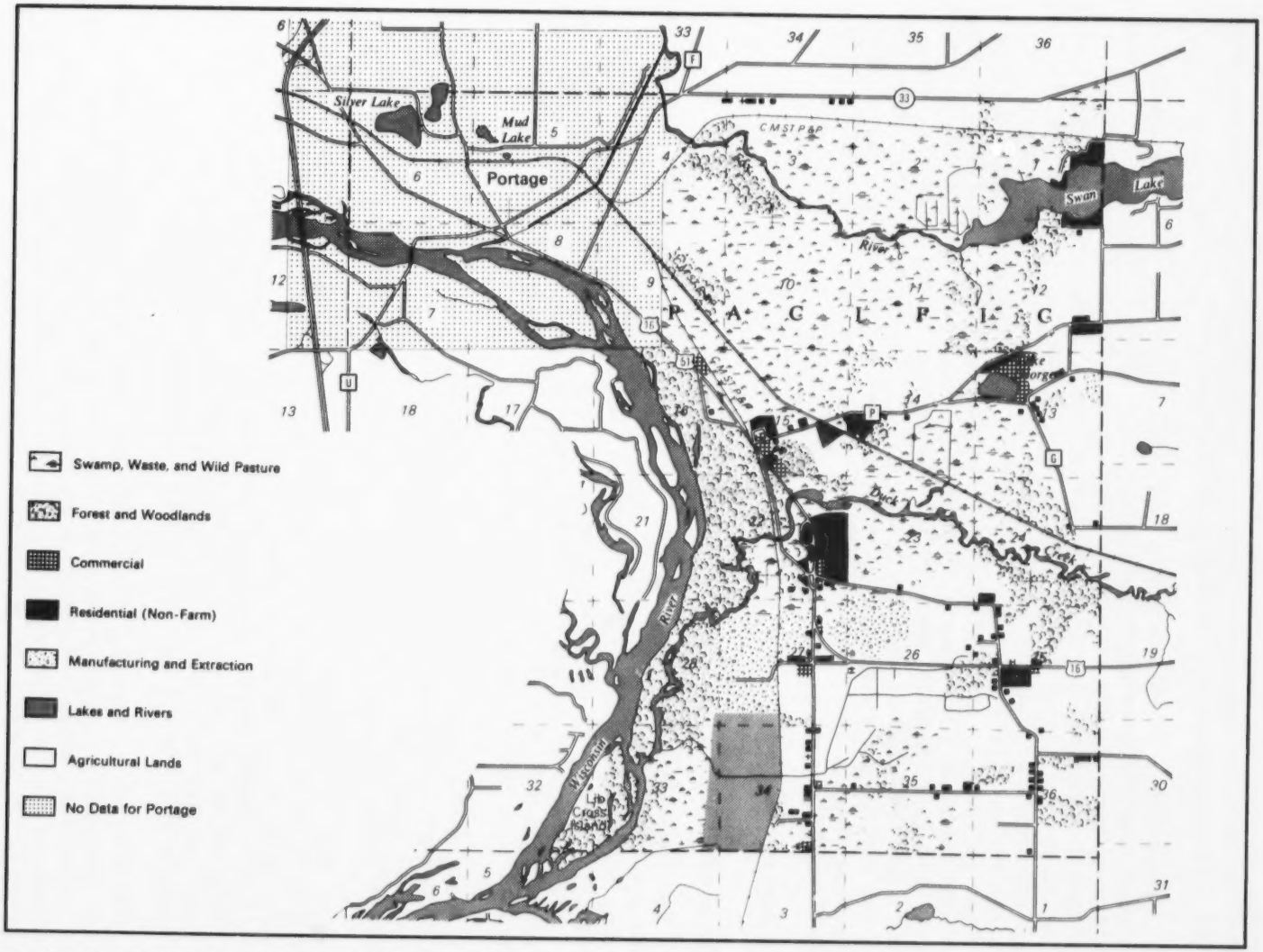

Figure 7. Land-use map for Pacific Township, Columbia County, Wisconsin--1975.

Township the rate was 6.2 acres per year. Additions to the manufacturing and extraction category and to the commercial category during the preconstruction period were negligible in Fort Winnebago, as in Pacific.

Gradual rates of change in the land-use patterns of Fort Winnebago persisted from the preconstruction period into 1970-75 (Figure 11). No change in the manufacturing and extraction category was detected. Commercial development during the postconstruction period was limited to the addition of two small enterprises in sections 30 and 31. In contrast to Pacific, Fort Winnebago continued its slow steady growth of residential development. The 1975 map reflects only the final expansion of the Redbird Estates Subdivision, plus the addition of a few scattered residential parcels. In Figure 12 the similarity between the rates of residential development for the two townships before 1970 is apparent. The acceleration of development in Pacific after 1970 is the most obvious feature of the graph. This acceleration contrasts with the earlier more gradual rate of development in the test area and with the gradual nearly uniform rate of development throughout the period in the control area.

LANDOWNERSHIP PATTERNS

Pacific Township

The 1962 landownership map for Pacific Township (Figure 13) depicts three major areas of corporate ownership. Most of the corporate property west of Highway 51 was owned by the Wisconsin Power and Light Company (WPL). The corporate property on the other side of Highway 51 comprises most of the holdings of the Martin Marietta Sand and Gravel Company. The corporate block located north and west of Swan Lake was owned primarily by the Columbia Corporation, a local land-holding company.

Absentee holdings are distributed randomly throughout the township. Most of the absentee-owned parcels were involved in frequent changes in ownership and in the categories of ownership. Nevertheless, the total area within the absentee category remained about the same throughout the analysis period.

The 1965 map of Pacific Township (Figure 14) shows an increase in the category of corporate ownership, resulting primarily from the expansion of the Martin Marietta holdings to include an additional 317 acres. The most significant change reflected in the 1968 map of this township (Figure 15) is the addition to the public category of a large parcel of 540 acres. Smaller increases in the corporate ownership category resulted mainly from acquisitions by WPL and the Lake George Development Corporation.

The 1971 map of Pacific Township (Figure 16) reflects the ownership pattern immediately after construction of the generating station began. The most significant changes are the expansion of the public holdings in the northwestern sector and the additions to the corporate category in the vicinity of the plant-construction site. The DNR added about 600 acres to its public holdings, and WPL acquired an additional 450 acres. In the northeastern corner of the town the Columbia Corporation added nearly 100 acres to its holdings.

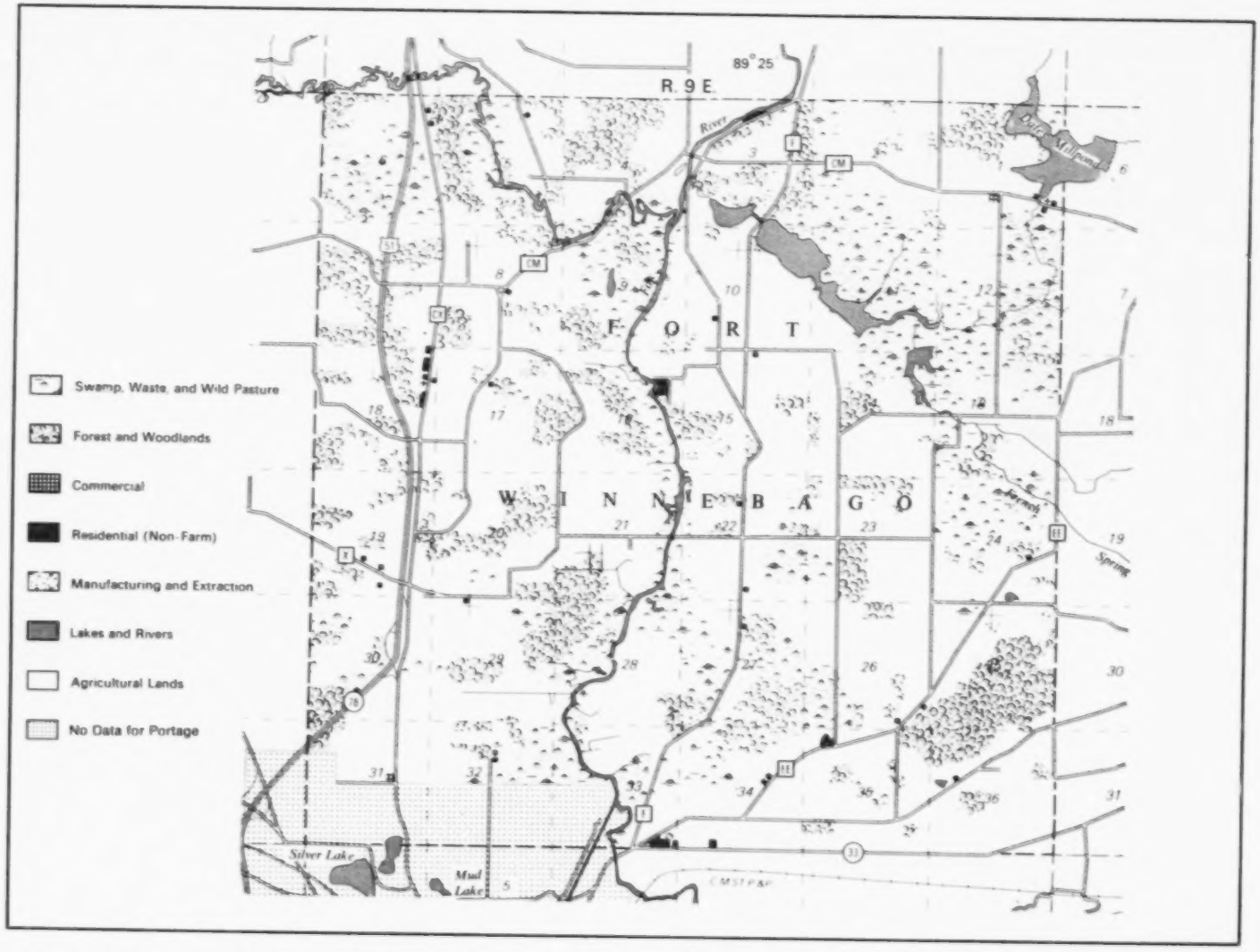

Figure 8. Land-use map for Fort Winnebago Township, Columbia County, Wisconsin--1962.

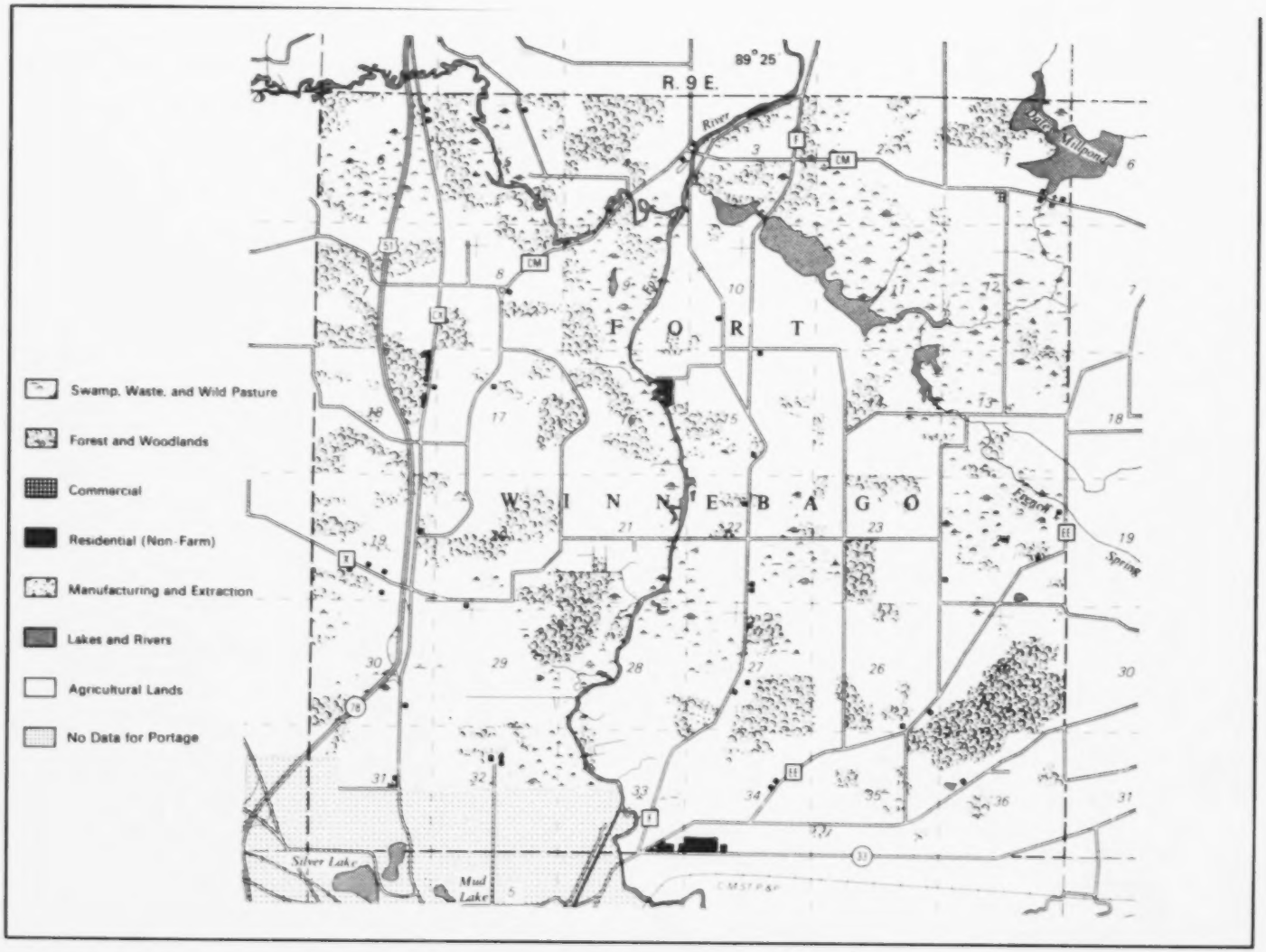

Figure 9. Land-use map for Fort Winnebago Township, Columbia County, Wisconsin--1968.

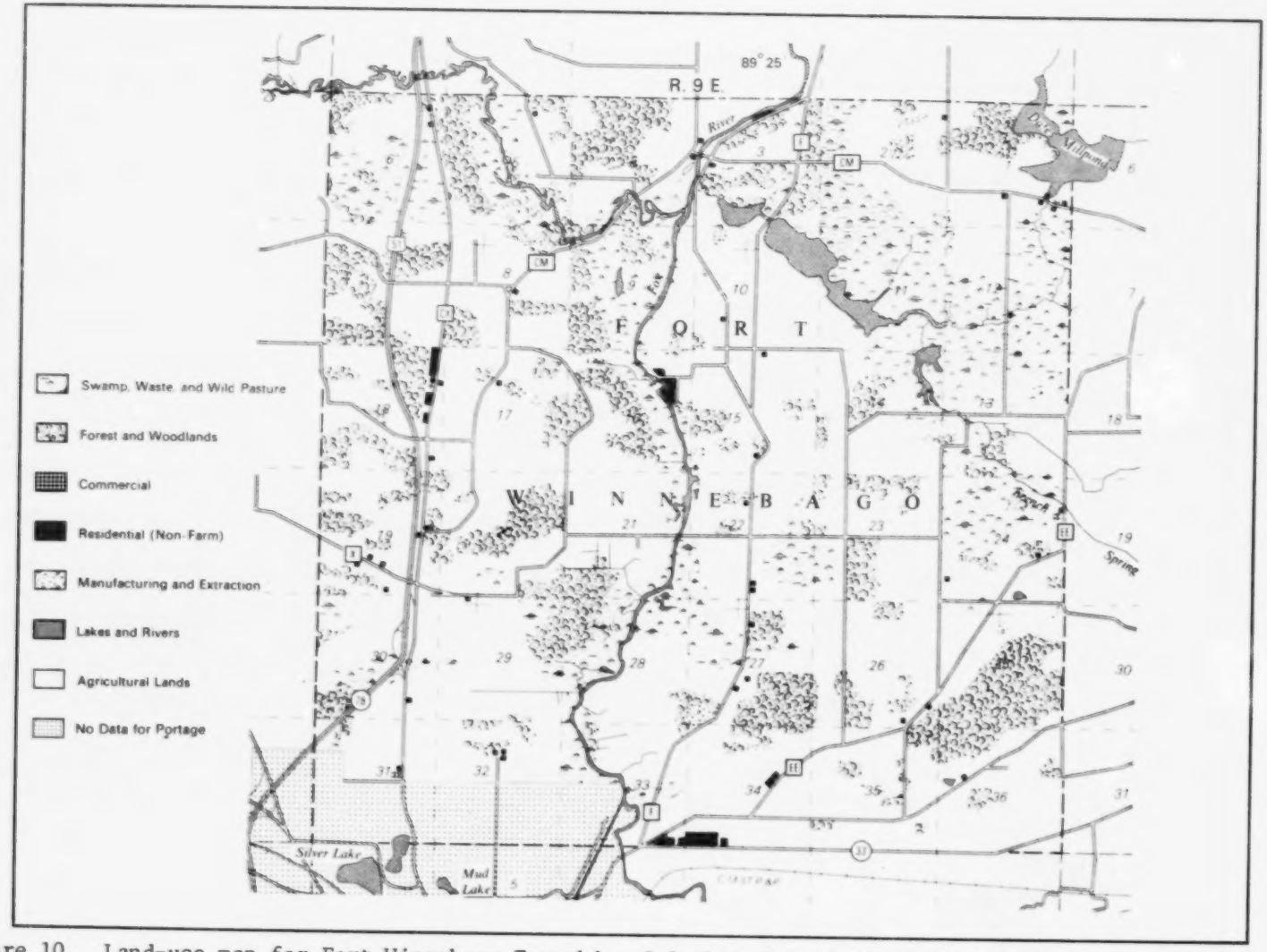

Figure 10. Land-use map for Fort Winnebago Township, Columbia County, Wisconsin--1970.

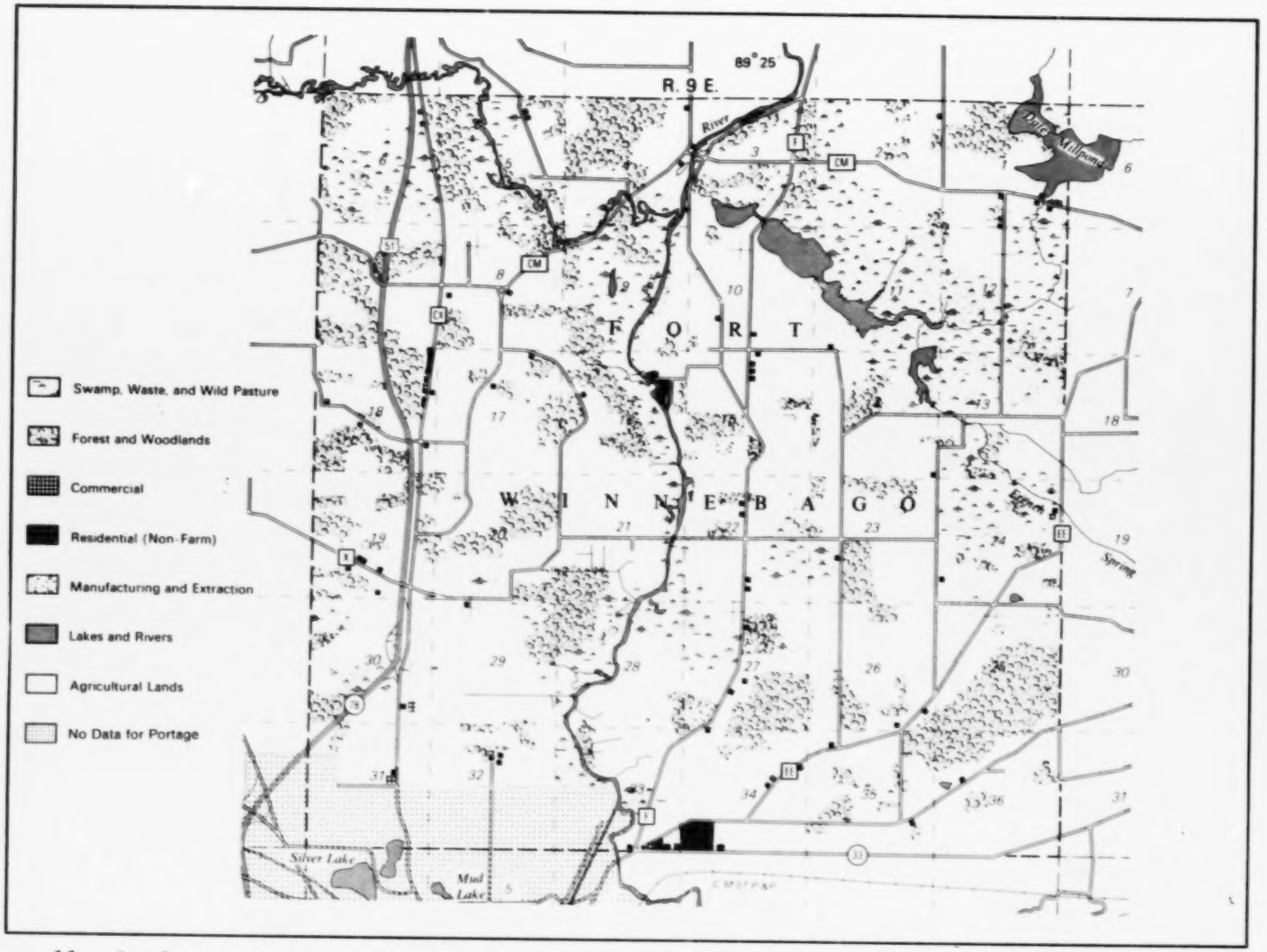

Figure 11. Land-use map for Fort Winnebago Township, Columbia County, Wisconsin--1975.

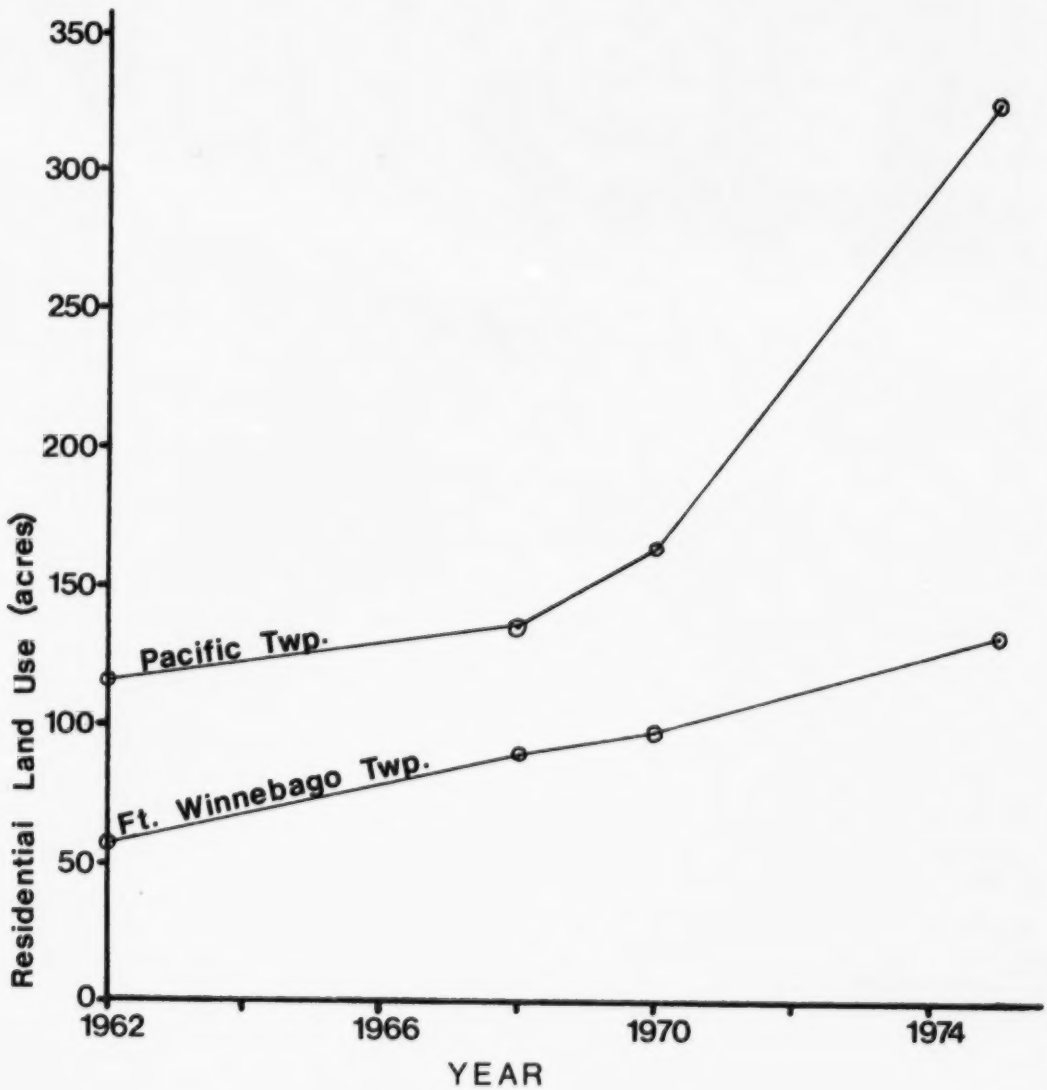

Figure 12. Residential land use in Pacific and Fort Winnebago townships, Columbia County, Wisconsin--1962-74.

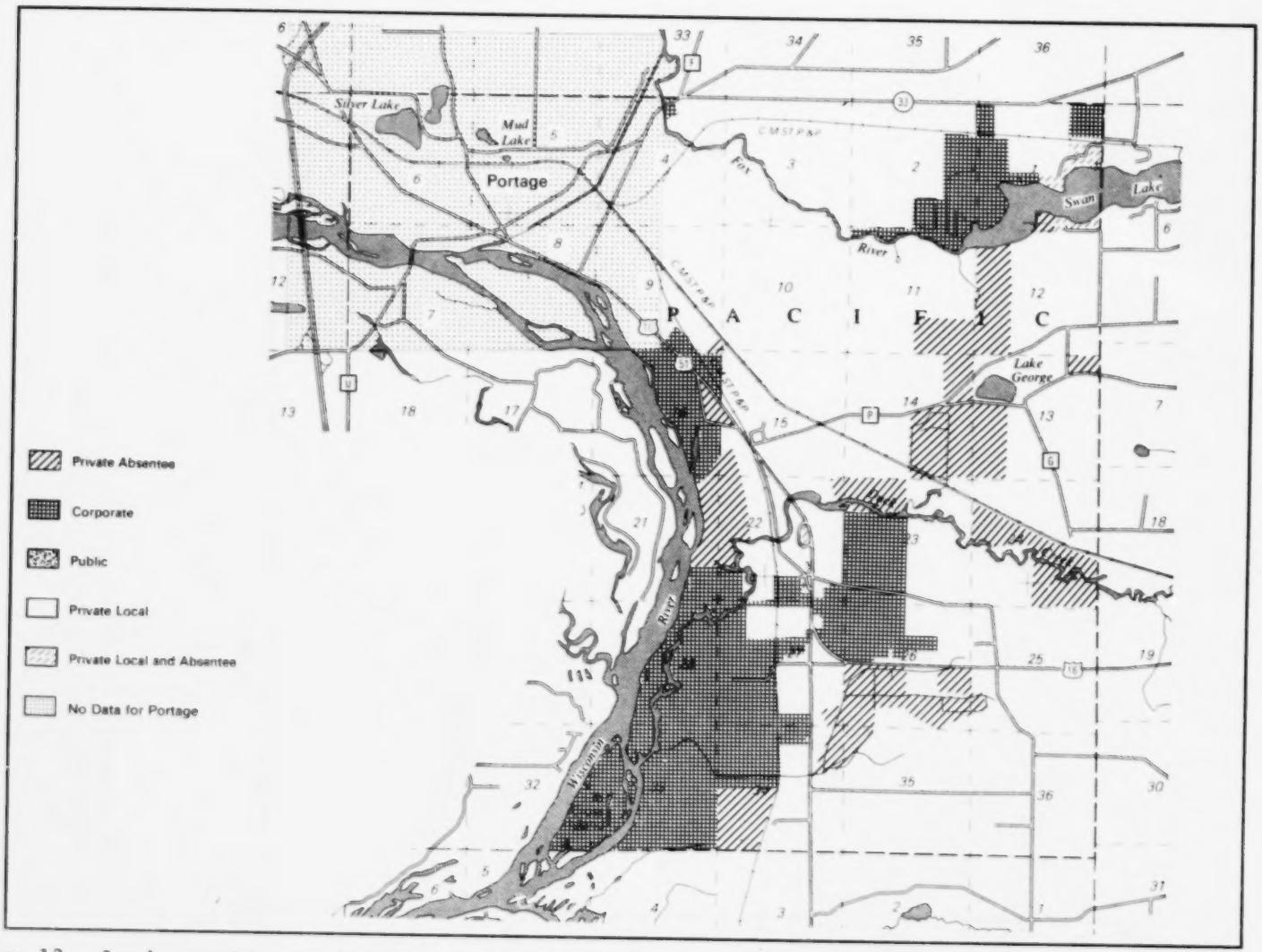

Figure 13. Landownership map for Pacific Township, Columbia County, Wisconsin--1965.

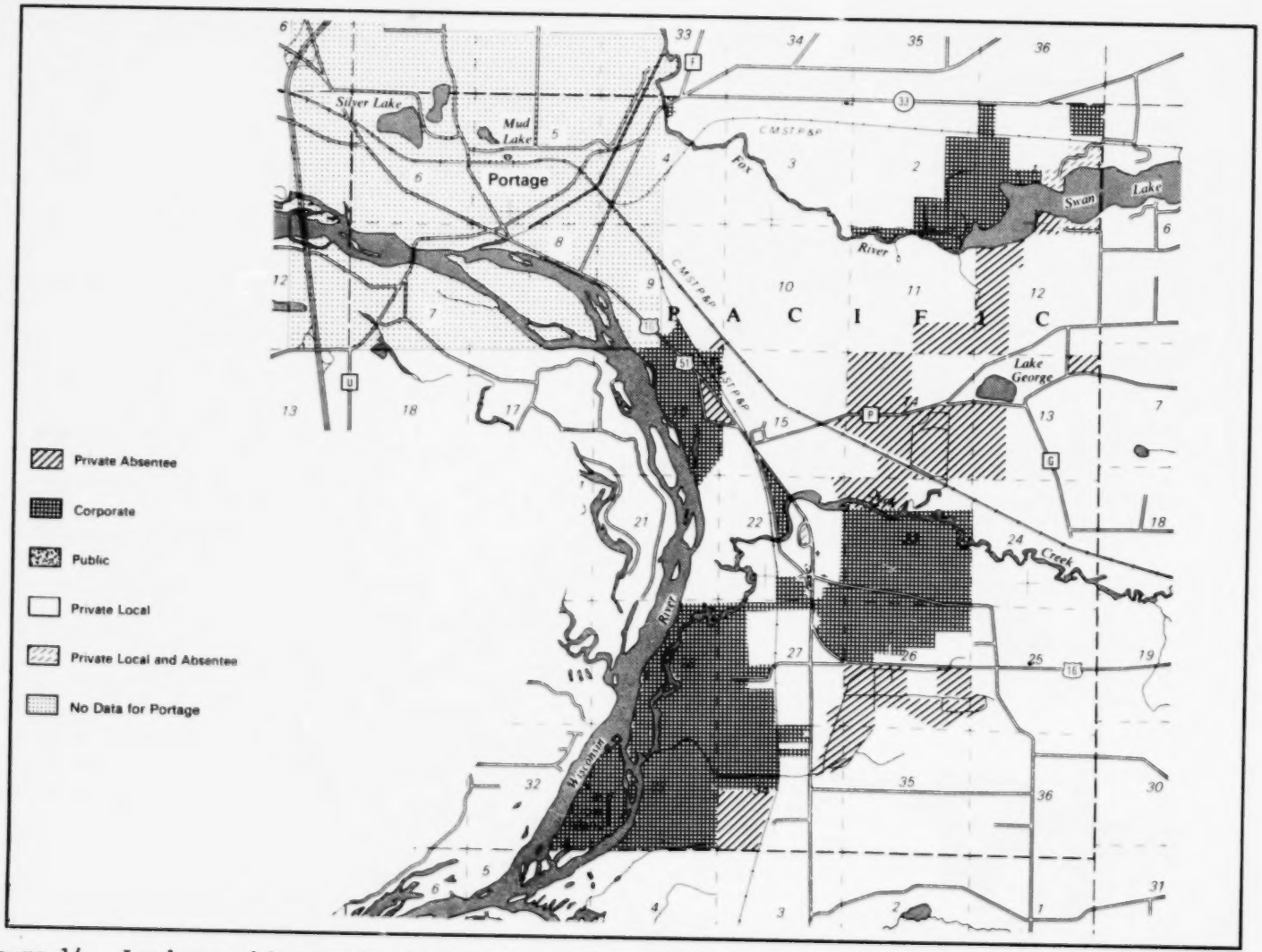

Figure 14. Landownership map for Pacific Township, Columbia County, Wisconsin--1965.

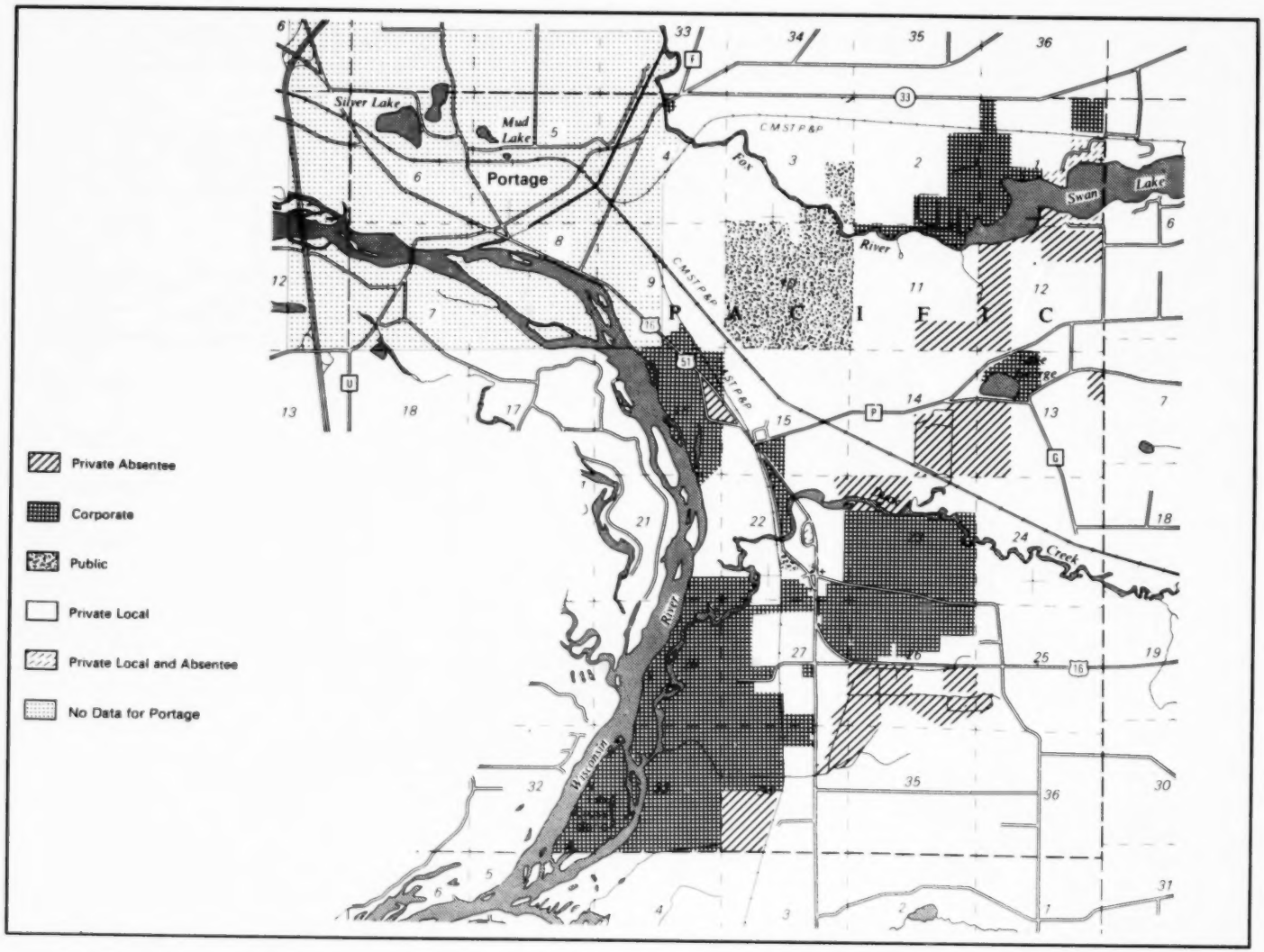

Figure 15. Landownership map for Pacific Township, Columbia County, Wisconsin--1968.

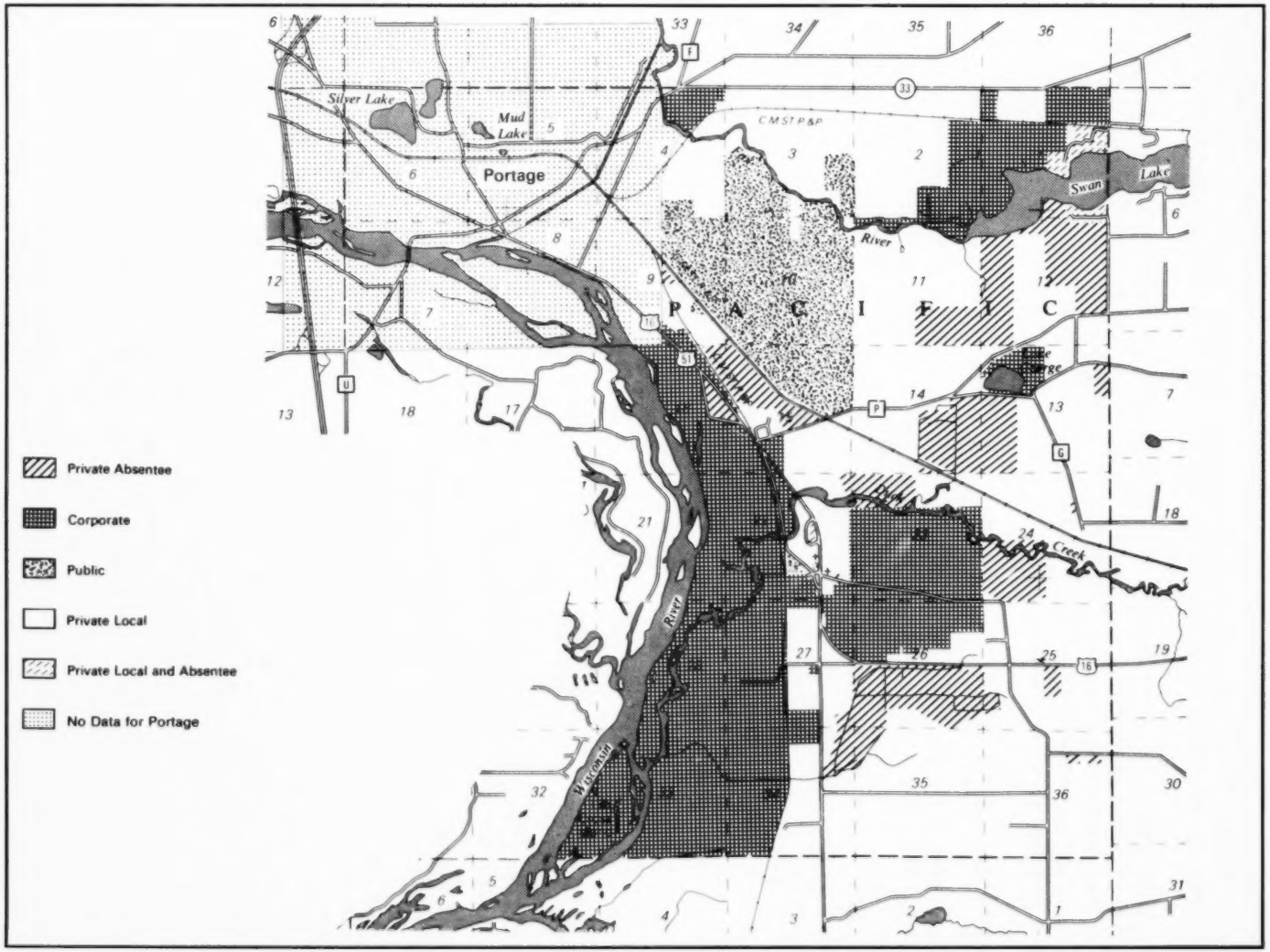

Figure 16. Landownership map for Pacific Township, Columbia County, Wisconsin--1971.

The 1974 map (Figure 17) depicts a further net increase of about 700 acres in the corporate category. Of this, WPL acquired about half (380 acres). The remaining purchases were made by small corporations, such as Georgetown Homes, Inc., and Ryan of Wisconsin, a subcontractor of WPL. Their acquisitions in sections 25 and 27 were 155 ac and 66 acres, respectively.

The most significant change in the percentages of each category of ownership in Pacific Township from 1962 to 1974 is the pronounced decline in local private ownership between 1968 and 1971 (Figure 18). This decline, resulting from sizable increases in both public and corporate ownership, cannot be directly attributed to effects of the power plant.

Fort Winnebago Township

The historical landownership maps of Fort Winnebago Township (Figure 19, Figure 20, Figure 21, Figure 22, and Figure 23) contrast with those presented for Pacific. The 1962 map shows local private ownership dominant, but also depicts a sizable block (1,750 acres) of public area. The initial scatter of absentee- and corporate-owned parcels seems almost insignificant. The major change reflected in the 1965 map is the increase in absentee holdings in the southern portion of the town, which resulted from the acquisition of about 600 acres of wetland for the purpose of muck farming. The succeeding maps for 1968 and 1971 reflect little change in the relative proportions of the various ownership categories. The gradual increase in the corporate category along the southern border of the township is caused by acquisitions totaling nearly 450 acres by the Gunderson Construction Company and the Columbia Corporation. The continuation of this gradual corporate expansion is indicated in the 1974 map, most notably in the acquisition of 200 acres by Portage Gardens, Inc., an agribusiness enterprise located immediately north of Portage. Except for the 1962-65 period, no noticeable change can be detected in the relative proportions of absentee-owned property. The percentages of each ownership category by year for Fort Winnebago Township are shown in Figure 24.

CHANGES IN MEAN SIZE OF INDIVIDUAL HOLDINGS

As an extension of the analysis of change in landownership patterns, the mean size of individual property holdings for each township was computed for each of the study years. The computation was made by dividing the total amount of property (minus public property) by the total number of individual owners. The mean size of holdings in the test township of Pacific was significantly reduced from 57 to 31 acres, or a 46% decrease (Figure 25). The reduction in mean size of holdings in Fort Winnebago was also significant, from 83 to 63 acres, or a 24% decrease (Figure 25). The amounts of absolute reduction in each of the two areas are comparable. These reductions in the mean size of holdings were generally constant throughout the analysis period, which suggests that the construction of the power plant had little or no relationship to the changes that occurred.

The data may be somewhat misleading without additional discussion. First, the mean size of holdings in Pacific is inflated by the large blocks owned by WPL and the Martin Marietta Company. In 1975 they owned more than 2,800 acres, or about 21.5% of the entire township. The expansion of their

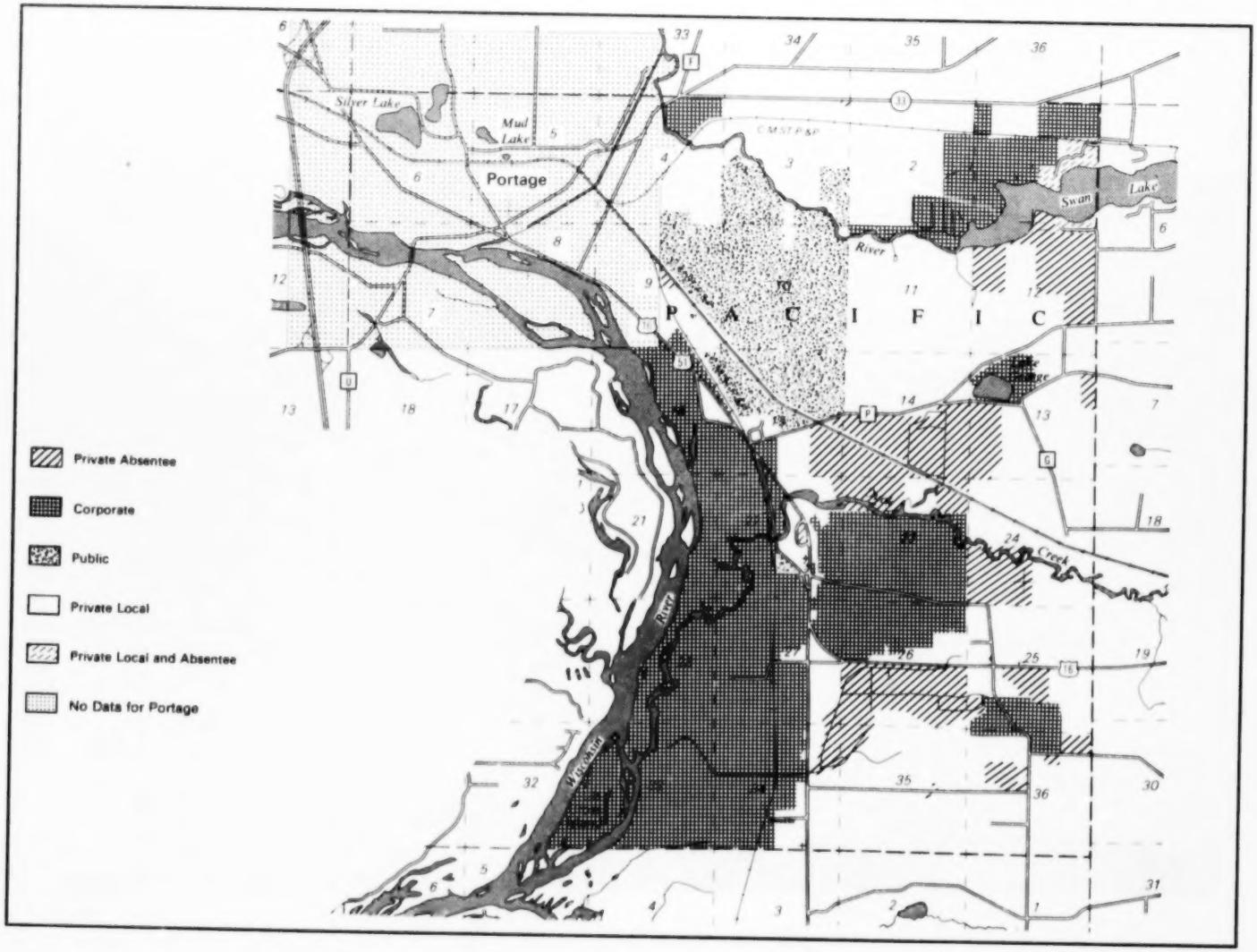

Figure 17. Landownership map for Pacific Township, Columbia County, Wisconsin--1974.

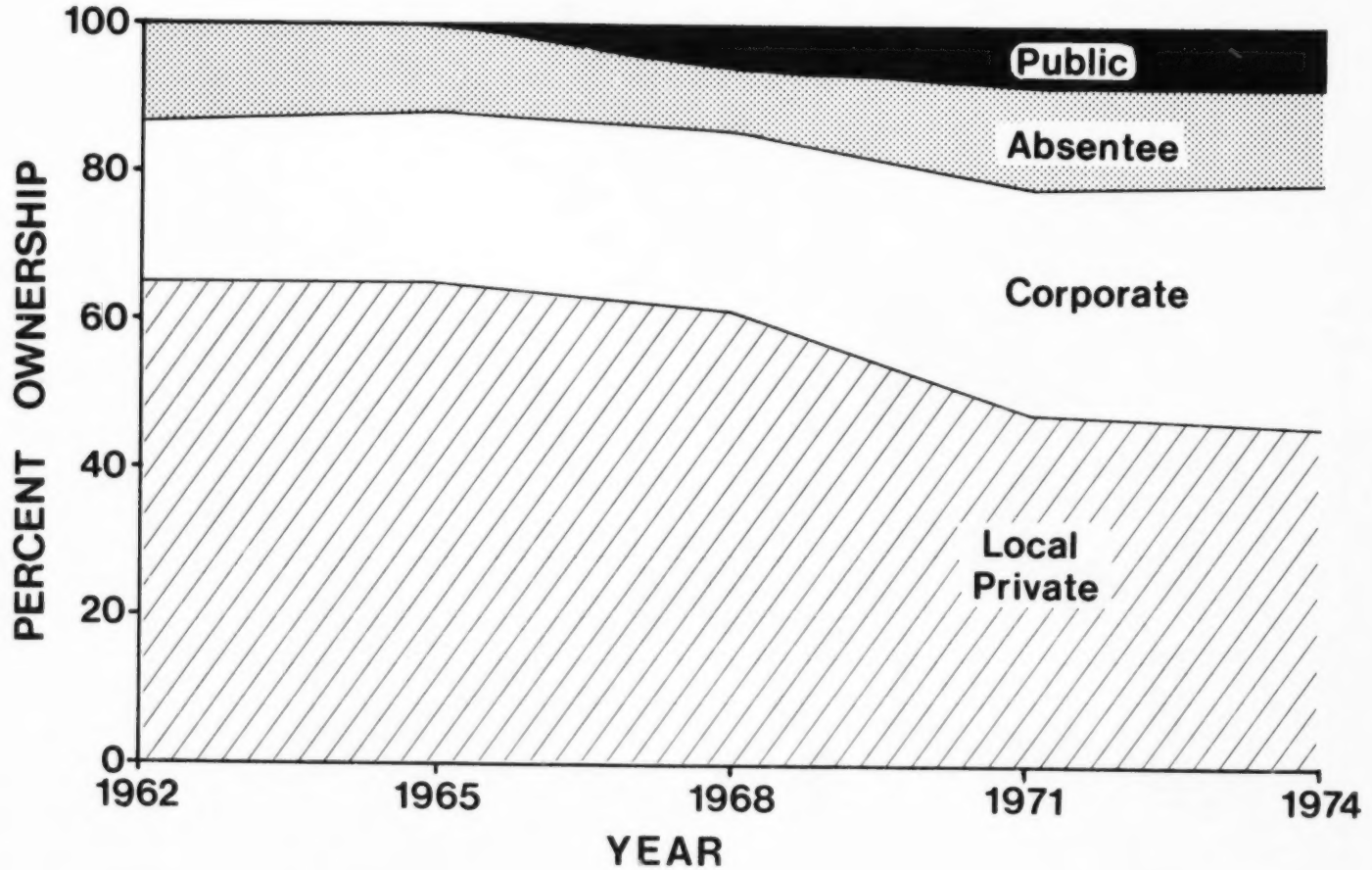

Figure 18. Percentage of land owned by four categories of owners in Pacific Township, Columbia County, Wisconsin--1962-74.

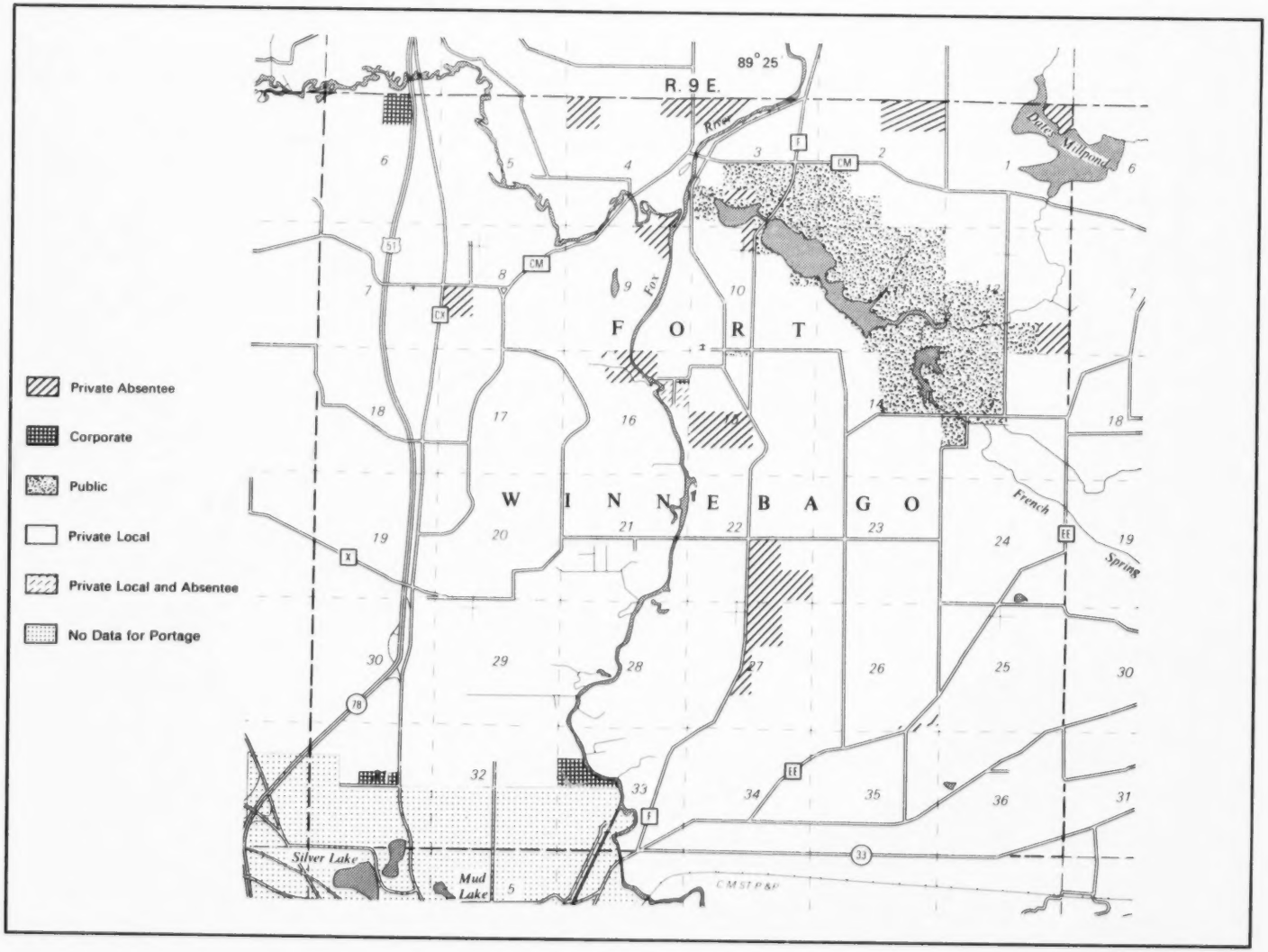

Figure 19. Landownership map for Fort Winnebago Township, Columbia County, Wisconsin--1962.

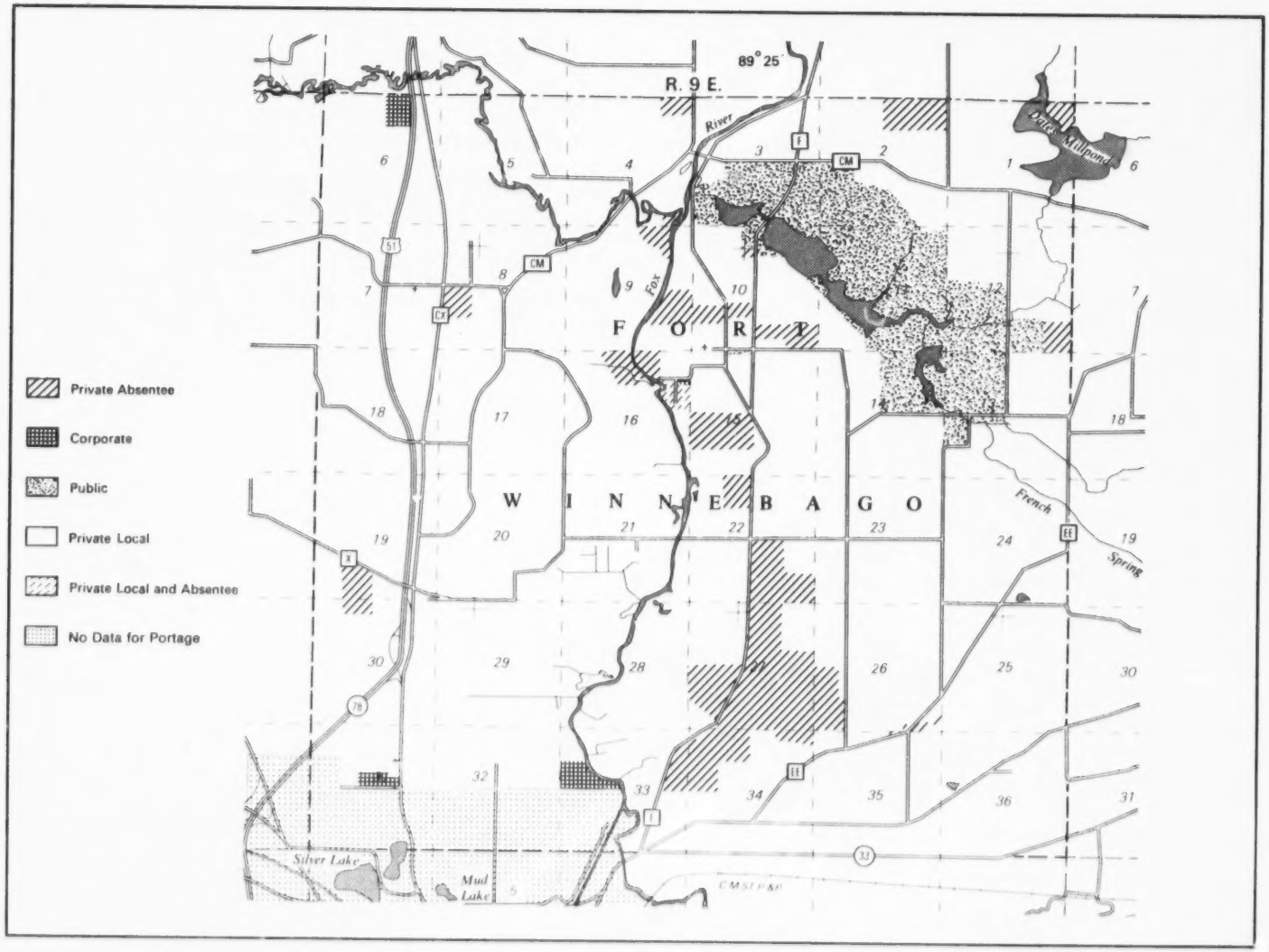

Figure 20. Landownership map for Fort Winnebago Township, Columbia County, Wisconsin--1965.

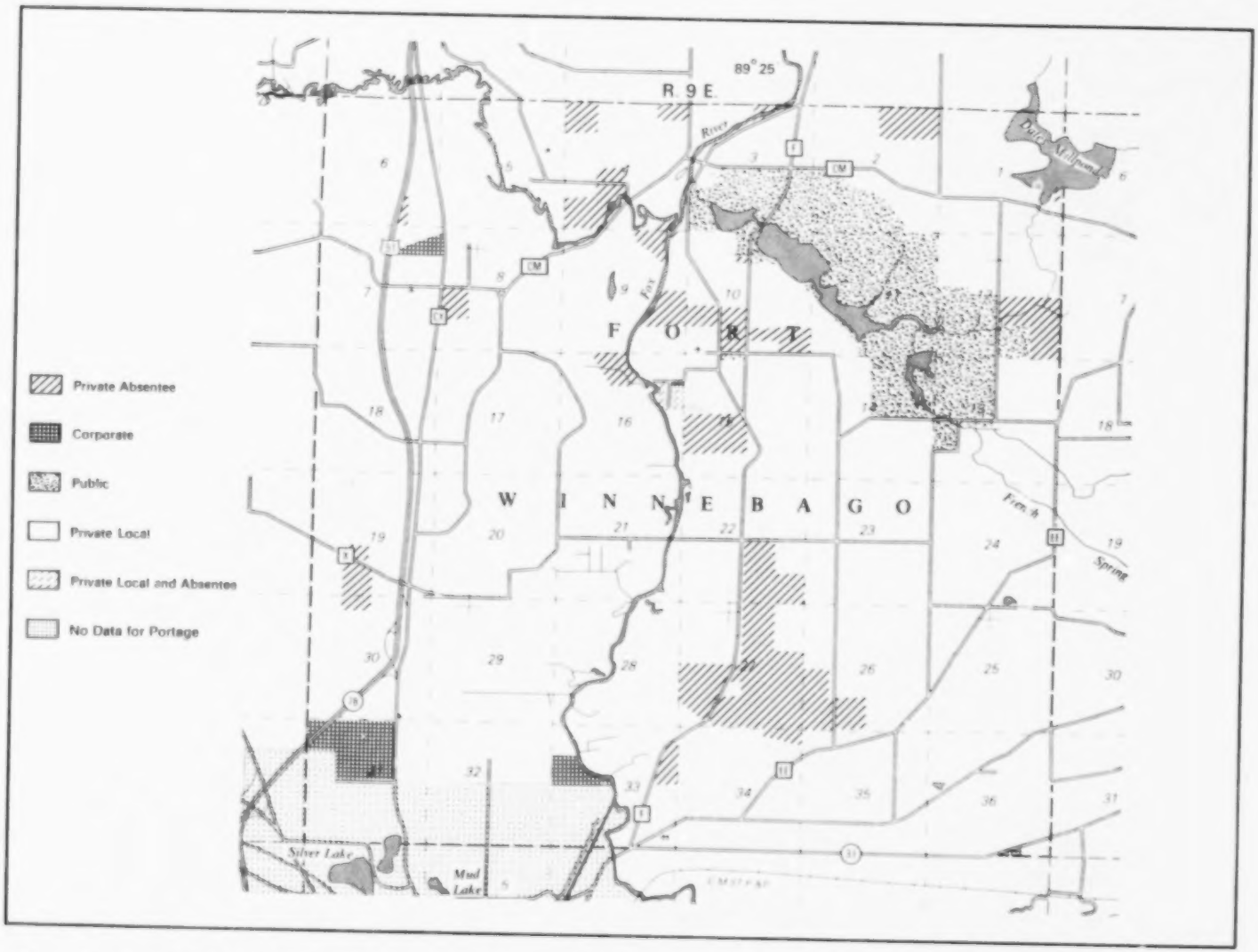

Figure 21. Landownership map for Fort Winnebago Township, Columbia County, Wisconsin--1968.

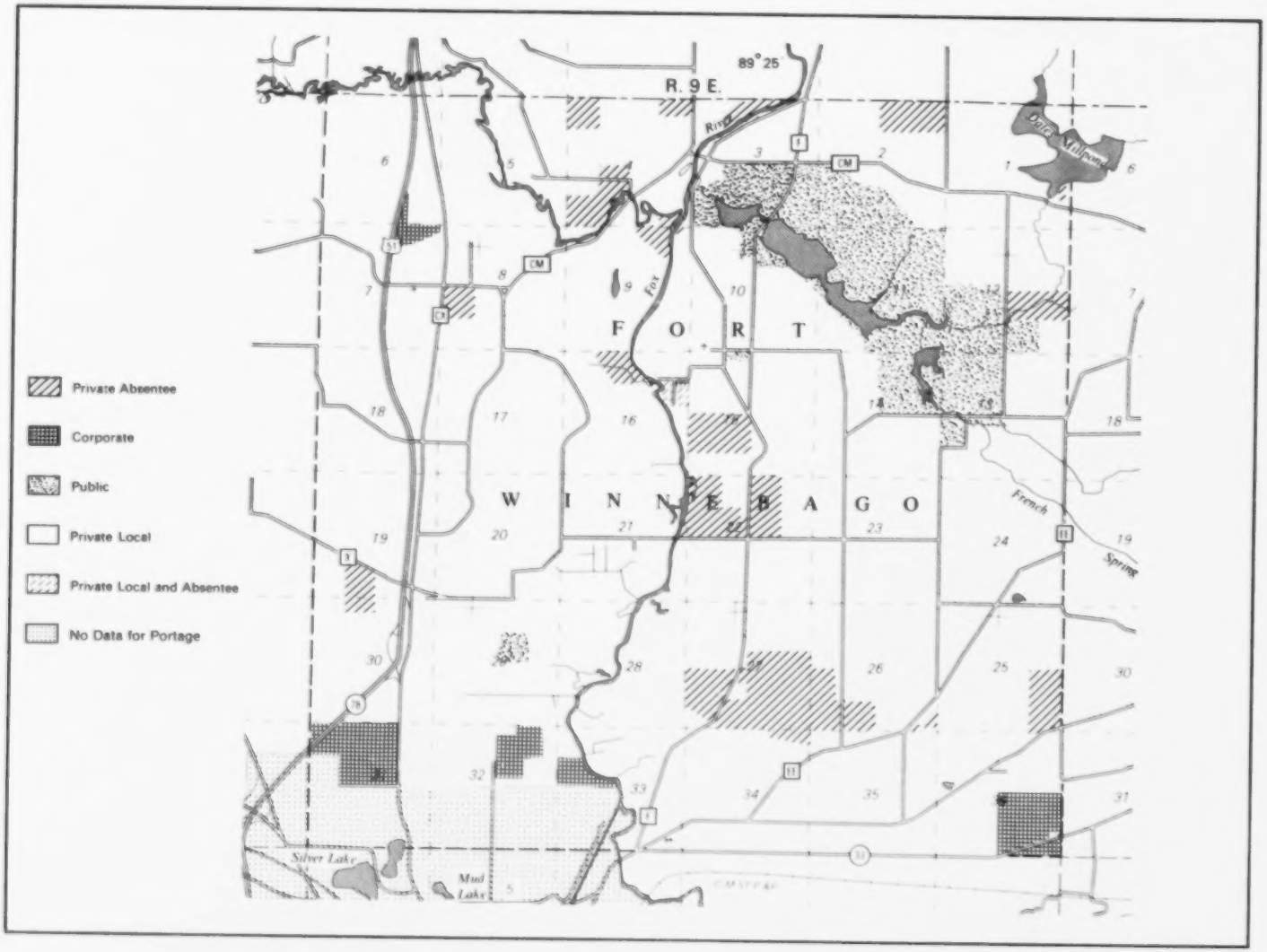

Figure 22. Landownership map for Fort Winnebago Township, Columbia County, Wisconsin--1971.

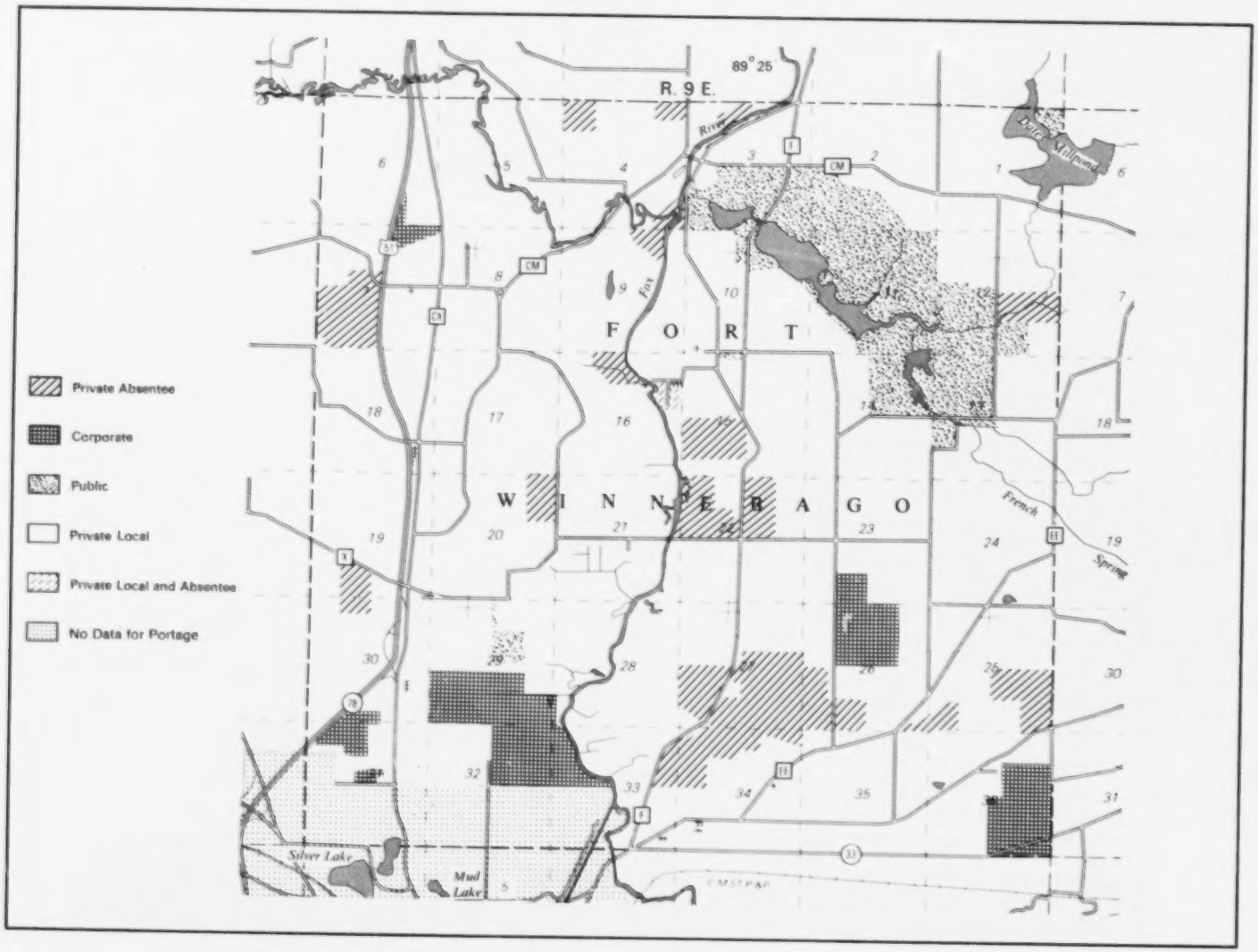

Figure 23. Landownership map for Fort Winnebago Township, Columbia County, Wisconsin--1974.

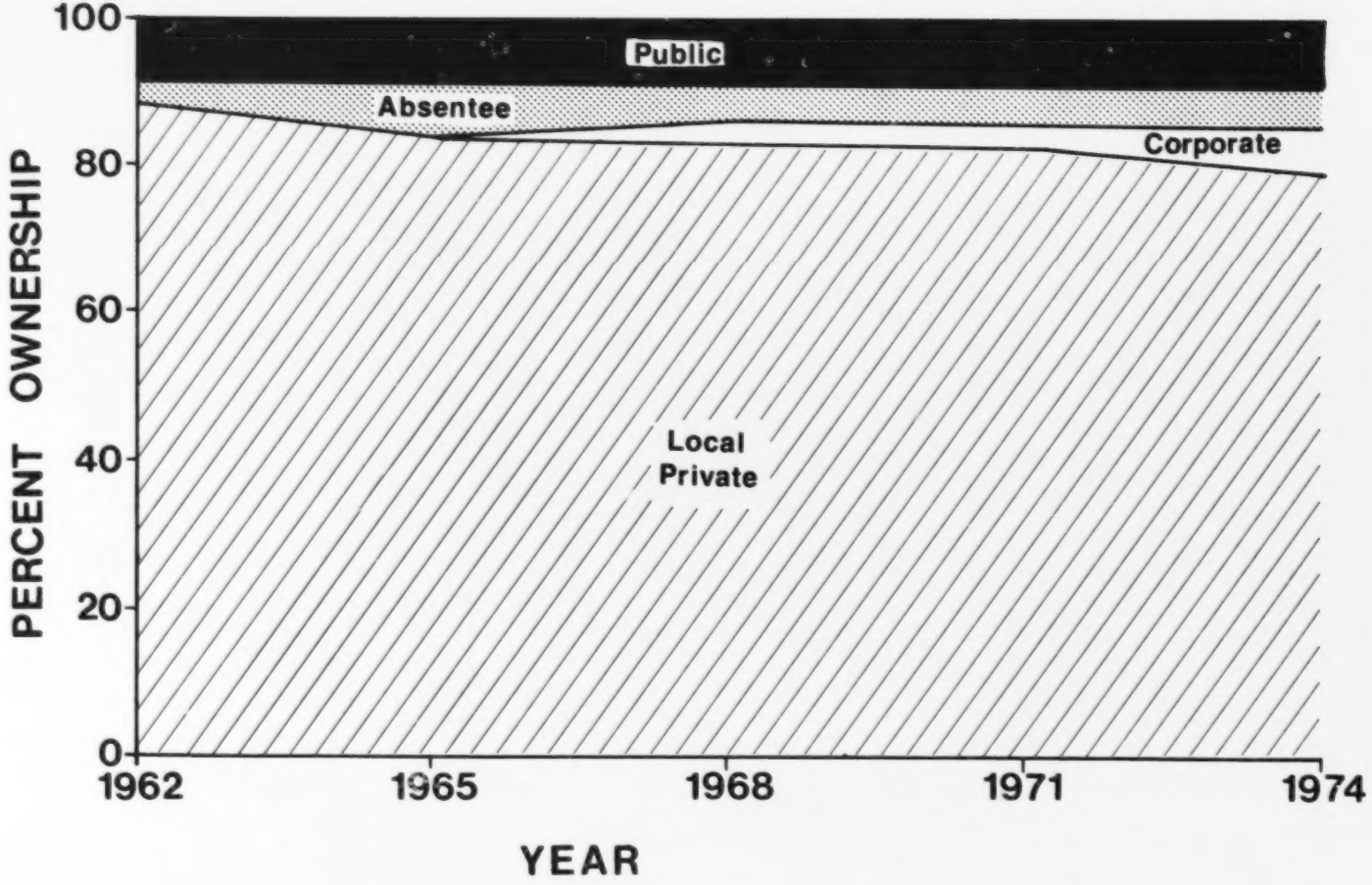

Figure 24. Percentage of land owned by four categories of owners in Fort Winnebago Township, Columbia County, Wisconsin--1962-74.

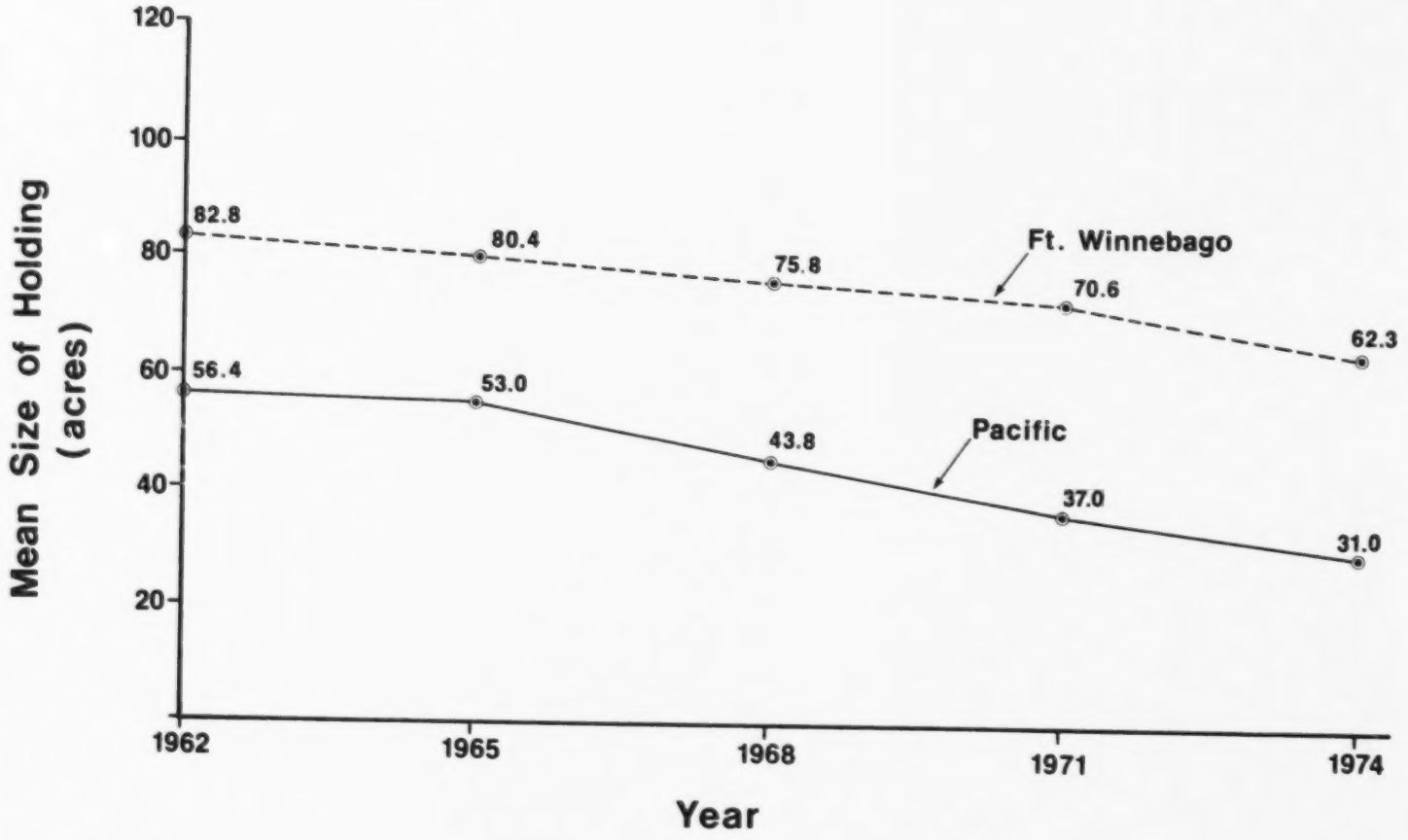

Figure 25. Mean size of property holdings in Pacific and Fort Winnebago townships, Columbia County, Wisconsin--1962-74.

holdings during the analysis period largely offset the reductions in the mean size of holdings in the remainder of the township. Second, the reduction in mean size of holdings is primarily attributable in both towns to residential subdivision and development. The recent trend in farm size throughout the county has been toward increasing acreage. From 1940 to 1964 average farm size increased from 150.6 to 186.1 acres (Columbia County, Wisconsin, Planning Department 1970a). The impact of this change on mean size of holdings is insignificant, however, compared to that of residential subdivisons, which add large numbers of small-acreage property owners. Thus, in Fort Winnebago the major contributing factor to the reduction in the mean size of property holdings was the addition of the Redbird Estates Subdivison, consisting of 61 half-acre lots which were sold between 1965 and 1974. The recently platted subdivisons in Pacific add 110 new residential-size lots. However, very few of these lots are reflected in the data prior to the survey cutoff date, 31 April 1974. Their subsequent inclusion in the data would undoubtedly involve a marked reduction in the mean size of holdings. Since no corresponding subdivision plats have been filed for Fort Winnebago, the differences in mean size of holdings between test and control area should become more pronounced.

PROPERTY-TRANSFER MATRICES

Property-sales data, extracted from the transfer extract, were aggregated in 3-yr blocks to coincide with the ownership maps and to reduce the annual variance. The sales data, including both the total number of sales and the total acreage sold, were organized into matrices identifying the ownership category of both the buyer and the seller (Table 3, Table 4). The vertical index identifies the ownership category of the seller, and the horizontal axis identifies that of the buyer. For example, during the 1962-64 period in Pacific there were six sales totaling 339.8 acres that involved a local private seller and a corporate purchaser. These sales matrices were especially useful in verifying category changes noted in the landownership maps. As the matrices indicate, corporate and absentee purchases slightly exceeded corporate and absentee sales throughout the analysis period. Corporate purchases increased in Pacific from 1971 to 1973 (25 compared with 8, 5, and 13 in the previous 3-yr periods). This increase may be related to the existence of the power plant, but we feel that no conclusion can yet be drawn.

CHANGES IN MEAN SIZE OF PROPERTY SALES

The sales data were used to calculate the mean size of individual sales for each 3-yr period. Up to 1970 the mean size of individual sales decreased similarly in both townships, indicating the similar rates of residential development earlier documented for these periods (Figure 26). From 1971 to 1973 the increase of the mean size of sales in Fort Winnebago represents the diminishing impact of residential subdivisions there, whereas the corresponding reduction in mean size of sales for Pacific represents the rising impact of the more recent subdivisions there. The mean size of sales in Pacific dropped from more than 41 acres at the start of the analysis period to only slightly more than 10 acres during 1971-73, a 75% reduction. Although the mean size of sales dropped noticeably in Fort Winnebago during the

TABLE 3. PROPERTY-TRANSFER MATRICES FOR PACIFIC TOWNSHIP SHOWING NUMBER OF ACRES TRANSFERRED AND NUMBER OF PROPERTY SALES AMONG FOUR CATEGORIES[a] OF BUYERS AND SELLERS FOR TRIENNIAL PERIODS FROM 1962 TO 1973

Years		Acreage matrices					Sales matrices					
			Buyer category						Buyer category			
			(1)[a]	(2)	(3)	(4)			(1)	(2)	(3)	(4)
1962-64	Seller category	(1)	1,106.7	471.1	339.8		Seller category	(1)	47	9	6	
		(2)	651.1	496.3				(2)	10	5		
		(3)	168.4		40.0			(3)	2		2	
		(4)				10.3		(4)				1
			Buyer category						Buyer category			
			(1)	(2)	(3)	(4)			(1)	(2)	(3)	(4)
1965-67	Seller category	(1)	1,073.9	33.?	202.9	631.4	Seller category	(1)	72	10	4	7
		(2)	303.8	17.3	86.1			(2)	7	4	!	
		(3)	16.0	86.1				(3)	2	1		
		(4)	0.7					(4)	1			
			Buyer category						Buyer category			
			(1)	(2)	(3)	(4)			(1)	(2)	(3)	(4)
1968-70	Seller category	(1)	353.3	468.9	459.8	649.4	Seller category	(1)	58	18	9	10
		(2)	0.6	134.9	204.0	23.7		(2)	1	4	2	2
		(3)	34.6		24.0	1.0		(3)	3		2	1
		(4)						(4)				
			Buyer Category						Buyer category			
			(1)	(2)	(3)	(4)			(1)	(2)	(3)	(4)
1971-73	Seller category	(1)	514.2	261.4	439.9		Seller category	(1)	100	11	20	
		(2)	211.3	48.2				(2)	7	2		
		(3)	1.3		50.7			(3)	3		5	
		(4)						(4)				

[a]Category (1), local private; category (2), absentee; category (3), corporate; category (4), public.

TABLE 4. PROPERTY-TRANSFER MATRICES FOR FORT WINNEBAGO TOWNSHIP SHOWING NUMBER OF ACRES TRANFERRED AND NUMBER OF PROPERTY SALES AMONG FOUR CATEGORIES[a] OF BUYERS AND SELLERS FOR TRIENNIAL PERIODS FROM 1962 TO 1973

Years		Acreage matrices					Sales matrices				
			Buyer category					Buyer category			
			(1)[a]	(2)	(3)	(4)		(1)	(2)	(3)	(4)
1962-64	Seller category	(1)	529.8	821.5	2.4	166.3	(1)	53	12	2	16
		(2)	121.0	145.4	0.8		(2)	3	2	1	1
		(3)			0.8		(3)			1	
		(4)				5.1	(4)				2
			Buyer category					Buyer category			
1965-67			(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
	Seller category	(1)	454.3	4.8	190.8	202.9	(1)	33	4	3	20
		(2)	53.3	62.7			(2)	6	8		
		(3)	0.5				(3)	1			
		(4)	1.1			0.8	(4)	1			1
			Buyer category					Buyer category			
1968-70			(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
	Seller category	(1)	951.3	352.9	230.4	42.0	(1)	39	9	4	1
		(2)	57.0	19.8			(2)	2	2		
		(3)	7.5			40.0	(3)	3			1
		(4)					(4)				
			Buyer category					Buyer category			
1971-73			(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
	Seller category	(1)	3,457.6	441.0	463.4	40.1	(1)	93	5	6	1
		(2)	144.2	584.3			(2)	3	5		
		(3)	3.4				(3)	3			
		(4)	10.8				(4)	1			

[a]Category (1), local private; category (2), absentee; category (3), corporate; category (4), public.

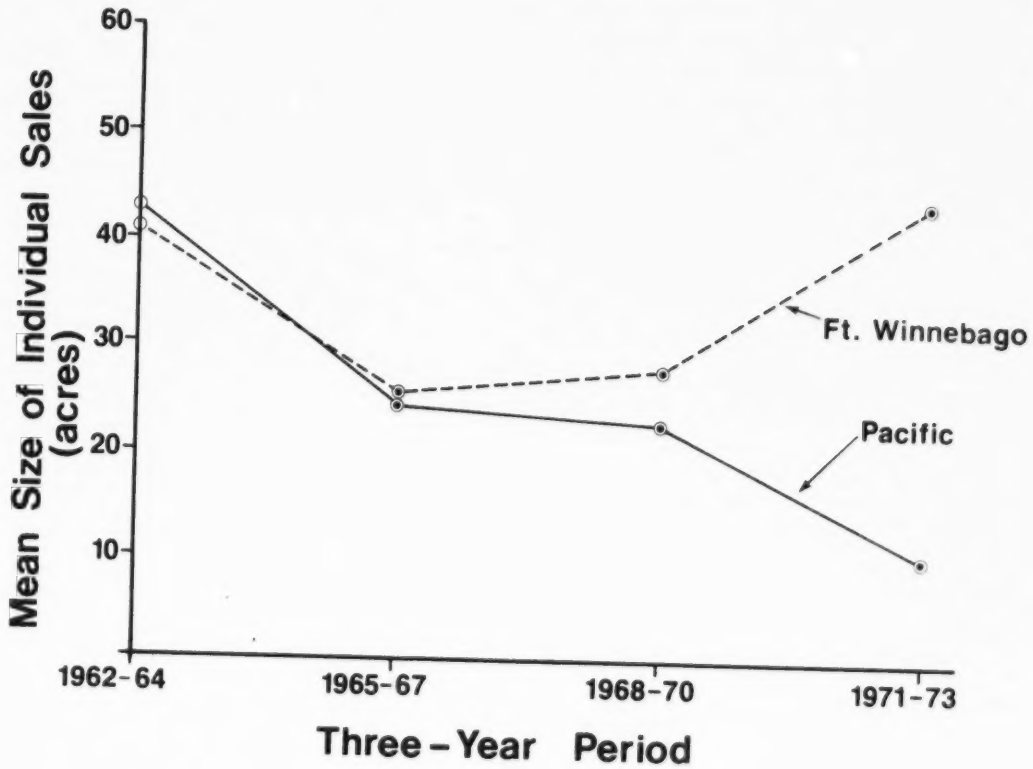

Figure 26. Mean size of property sales in Pacific and Fort Winnebago townships, Columbia County, Wisconsin, for triennial periods from 1962 to 1973.

intermediate periods, it regained its earliest level by the 1971-73 period at the close of the survey.

Like the property-holding data (Figure 25), the property sales data do not include the effects of the most recent residential subdivisions in Pacific. The survey of property sales included accurate data only up to 31 April 1974, by which time only about 25 of the newly created 110 residential lots had been sold. The imminent sale of the remainder of these lots will undoubtedly reduce the mean size of individual sales still further in the near future. Final documentation of this occurrence must await further research. The existence of these limitations or problems again serves to underscore the preliminary nature of this assessment and the need to continue data collection.

SECTION 6

DISCUSSION

This preliminary study is mainly significant in identifying the increased residential development that occurred in conjunction with the siting of a power plant and the creation of a tax island. This documentation of accelerated residential development is based on only one postconstruction sampling, encompassing just 4.5 yr. It is impossible to predict to what extent this initial trend will persist. Pacific's total property categorized as residential at the end of the survey period was still only 325 acres, a small proportion of the total area. Certain indications suggest, however, that the increased rate of residential development will probably persist or accelerate in the near future. The property-transfer records for the township reflect several large recent acquisitions by individuals and agencies specializing in residential development, such as the November 1973 purchase of 155 acres by Georgetown Homes Incorporated. The landownership records indicate that much of the property surrounding recently platted subdivisions in Pacific is still owned by developers and is equally well suited to residential use. In fact, the official plats depict various expansion features incorporated in the design of these subdivisions. Some plats already depict future additions not yet approved or incorporated in the data. Although actual future rates of development in Pacific may be affected by economic factors such as the housing market and interest rates, the potential for sustained acceleration of development clearly exists in Pacific Township. The data for Fort Winnebago do not reveal any similar potential for accelerated development.

The evidence of increased residential development associated with the power plant and the resulting tax island does not establish a causal relationship. The documentation required to establish a causal relationship would entail expansion of temporal and spatial bounds, increased control of variables, and application of the model to universal conditions. The efficacy of an undertaking of this sort is highly questionable, since the existence of a causal relationship is quite doubtful. More likely, plant construction and the resultant influx of revenues simply establish preconditions which <u>may</u> lead to the type of accelerated development noted for Pacific. Host communities need not employ utility-tax revenues solely for property-tax relief. They may choose to spend the funds on various social programs, which may or may not induce different types of development. They could, for example, employ funds to establish an industrial park, serving to attract industry and to create new job opportunities. They could invest the funds in a scenic park or a recreation area, designed to attract tourists and related development. As either an alternative or a supplement to such actions, the host community could exercise land-use controls, such as zoning, to control or restrict

development. Specific examples of the employment of zoning were noted by the PSC study in the communities surrounding the Point Beach and Kewaunee Generating Stations on Lake Michigan. Local zoning, instituted subsequent to plant construction, was used in these instances, "to exclude development in order to retain maximum tax benefits within the local municipality" (Wisconsin Public Service Commission 1975a).

Although the major thrust of this research has been the identification of utility-induced development resulting from the test area's comparative tax advantage, a secondary concern, evident in the landownership analysis, has been the attempt to identify the agents of anticipated development. Part of the hypothesis was that local landowners would probably lack the capital and expertise needed to develop their properties. Thus, we anticipated that absentee and corporate purchasers with the requisite skills and money would exploit the situation, inducing land speculation and change in ownership patterns. However, we found no discernible change in the extent of absentee ownership and very little increase in corporate ownership attributable to land speculation in the test area. Except for the acquisitions traced to Georgetown Homes and the Columbia Corporation, all the land speculation and development activities suggested by the transfer data were traced to local individuals, primarily residents of Portage. This circumstance is especially evident in the transfer of parcels containing recently platted subdivisions. The hypothesis apparently failed to appreciate the extent of capital and development expertise available in Portage. Discussion of transfer records with local officials indicated that property owners desiring to develop their property frequently enter into various agreements with realty agencies, whereby the realtor provides the requisite capital and development expertise in return for a commission on resulting sales. This practice, enabling the original owner to retain possession until the final sale to a residential buyer, was evident in the transfer records relating to the sale of residential parcels in many of the subdivisions identified by the study. This may be a further explanation of the absence of hypothesized changes in the landownership categories.

The initial trend toward accelerated residential development is considered significant, since it portends wide-ranging consequences of power-plant siting. Although this study has focused on only one specific instance of power-plant siting, the analysis suggests that similar results might be obtained for other Wisconsin communities where plants have been or are being constructed. The PSC report of December 1975 upholds the extension of these findings. "The major effects of the utility tax rebate has thus been to create small tax islands whose residents were able to receive a very high level of public services at little or no direct cost to individual tax payers. This situation has the potential to create spinoff impacts on property values and development in the local community. Depending on the type of zoning which exists in the community, the low tax rate and/or the high level of services may serve to attract various types of development and drive property values up" (Wisconsin Public Service Commission 1975b). In discussing the data collected for the seven plant sites studied, the same PSC report noted, "The most significant increase in property values was for residential property in the Township containing the plant site." Five of the host communities surveyed by the PSC "experienced significant growth in the residential sector." The

data for one site were considered inconclusive because of the recency of plant construction. Only one site, the Valley Plant in Milwaukee, experienced no growth in any of the various property classes. The occurrence of accelerated residential development in conjunction with the siting of a power plant is obviously important to a wide variety of local and State agencies. The capacity of predicting this potential residential growth would therefore be extremely useful to those agencies and to the host communities.

This research also provides an illustration of the system of disbursing utility-tax revenues in Wisconsin. As early as 1969 Tarr noted that they had "heard more complaints during hearings about the present utility sharing formula than any other State program" and concluded that "the imbalance caused by this formula should be corrected." As noted earlier, changes in the distribution system in 1971 and 1975 attempted to rectify the inequity of excessively large payments to local municipalities. The financial analysis of this study suggests, however, that recent changes in the distribution system have had little impact on the size of past or projected payments to Pacific Township. Utility payments are supposed to provide equitable compensation to municipalities containing non-taxable utility property. The magnitude of the payments documented for Pacific, enabling the town to abolish property taxes and amass an investment fund of over $4 million in 10 yr, seems to exceed what is implied by the term "compensation." The finding of this reseach, suggesting that the influx of utility revenues may create preconditions for accelerated residential development, also implies that utility payments, at least in this instance, exceed equitable compensation. The influx of utility revenues documented by the Wisconsin Public Service Commission for other host communities suggests that Pacific Township is not an isolated example of large payments. The 1975 amendments to the distribution system have not affected payments based on existing plants, but they may be effective in reducing payments from future plants.

BIBLIOGRAPHY

Alston, F. 1972. Preferential taxation of agricultural and open space lands: A proposal for Wisconsin. Institute for Environmental Studies, Working paper 8F, Univ. Wisconsin-Madison, Madison, Wis. 57 p.

Barlowe, R. 1972. Land resource economics: The economics of real property. 2nd ed. Prentice Hall, Inc., Englewood Cliffs, N.J. 616 p.

Columbia County, Wisconsin, Planning Department. 1970a. A comprehensive development plan of Columbia County. County Board of Columbia County, Portage, Wis. 64 p.

Columbia County, Wisconsin, Planning Department. 1970b. Physical features analysis, Columbia County. Rep. 1. County Board of Columbia County, Portage, Wis. 55 p.

Columbia County, Wisconsin, Planning Department. 1970c. Existing land use, Columbia County. Rep. 2. County Board of Columbia County, Portage, Wis. 52 p.

Columbia County, Wisconsin, Planning Department. 1970d. Population analysis, Columbia County. Rep. 3. County Board of Columbia County, Portage, Wis. 58 p.

Columbia County, Wisconsin, Planning Department. 1970e. Economic analysis, Columbia County. Rep. 4. County Board of Columbia County, Portage, Wis. 95 p.

Columbia County, Wisconsin, Planning Department. 1970f. Transportation analysis, Columbia County. Rep. 5. County Board of Columbia County, Portage, Wis. 81 p.

Columbia County, Wisconsin, Planning Department. 1971. Community facilities analysis, Columbia County. Rep. 6. County Board of Columbia County, Portage, Wis. 117 p.

Deknatel, C., and S. Harris. 1970. Zoning to preserve agriculture: Columbia County. Wisconsin Department of Administration, State Planning Office, Madison, Wis. 10 p.

Hardin, G. 1972. Living on a lifeboat, p. 375-384. In R.L. Smith [ed.] The ecology of man: An ecosystems approach. Harper and Row, New York.

Kusler, J. 1972. Rural land use in Wisconsin: A preliminary description of problems and preventive efforts. Institute for Environmental Studies, Working Paper 8A, Univ. Wisconsin-Madison, Madison, Wis. 144 p.

McLaughlin, J. 1975. Oral presentation before the Land Resources Seminar (Institute for Environmental Studies. Univ. Wisconsin-Madison, Madison, Wis. (22 September 1975.)

McMillan, M. 1975. A power plant in your community? Univ. Wisconsin-Extension, Bull. number G2666, Madison, Wis. 17 p.

Martin, L. 1965. The physical geography of Wisconsin. 3rd ed. Univ. of Wisconsin Press, Madison, Wis. 608 p.

Moyer, D.D. 1974. Land title records and recording procedures in the United States. Economic Research Services, U.S. Dep. Agriculture, Washington, D.C. 59 p.

Rockford Map Publishing Company. 1961. Plat book, Columbia County, Wisconsin. Rockford, Ill. 32 p.

Rockford Map Publishing Company. 1965. Tri-annual atlas and plat book, Columbia County, Wisconsin. Rockford, Ill. 34 p.

Rockford Map Publishing Company. 1968. Tri-annual atlas and plat book, Columbia County, Wisconsin. Rockford, Ill. 34 p.

Rockford Map Publishing Company. 1972. Tri-annual atlas and plat book, Columbia County, Wisconsin. Rockford, Ill. 34 p.

Rockford Map Publishing Company. 1974. Atlas and plat book, Columbia County, Wisconsin. Rockford, Ill. 36 p.

Rosner, M. 1974. Fiscal impact model: A simulation approach to analyzing the local fiscal impact of second home development. Unpublished.

Schmied, A.A. 1968. Converting land from rural to urban uses. Resources for the Future, Washington, D.C. 103 p.

Schmied, R.B. 1973. A case study of public information and participation in the siting of the Columbia Generating Plant. M.S. Thesis. Univ. Wisconsin-Madison, Madison, Wis. 152 p.

Shaffer, R.E. 1972. Evaluating the economic impact of new industry on Wisconsin communities. Univ. Wisconsin-Extension, Madison, Wis. 34 p.

Stauber, R.L. 1974. A technical guide for measuring the impact of tax base changes on the property tax burden in Wisconsin. Univ. Wisconsin-Extension, Madison, Wis. 51 p.

Tarr, C.W. 1969. The report of the task force on local government finance and organization in Wisconsin. Office of the Governor of Wisconsin, Madison, Wis. Various pagings.

Walrath, A.J. 1959. Impacts of changes in land use: A study of an urban-rural area of southeastern Wisconsin. Agric. Res. Serv., ARS43-95. U.S. Dep. Agriculture, Washington, D.C. 55 p.

Westwood Research Incorporated. 1974. Evaluation of potential socio-economic impacts of the construction and operation of Columbia Generating Station No. II. Appendix B of Environmental impact report, Columbia Generating Station, Unit No. II, Columbia County, Wisconsin. Wisconsin Power and Light Company, Madison Gas and Electric Company, Wisconsin Public Service Corporation, Madison, Wis. Various pagings.

Willard, D.E. 1973. Preliminary documentation of environmental change related to the Columbia electric power generating site. Institute for Environmental Studies, Working Paper 11, Univ. Wisconsin-Madison, Madison, Wis. 22 p.

Wisconsin Agricultural Experiment Station. 1943. Land tenure in process: A study of farm ownership and tenancy in a Lafayette County (Wis.) township. Wisconsin Agr. Exp. Sta. Res. Bull. 146. 48 p.

Wisconsin Department of Natural Resources. 1973. Draft environmental impact statement for Columbia Generating Station of the Wisconsin Power and Light Company. Madison, Wis. Various pagings.

Wisconsin Department of Natural Resources. 1974. Impact of state land ownership on local economy in Wisconsin. Tech. Bull. 80. 96 p.

Wisconsin Department of Revenue. 1975. Statistical report of property values, Columbia County, Wisconsin. Madison, Wis. Various pagings.

Wisconsin Legislative Reference Bureau. 1973. History of the provisions of section 76.28 of the Wisconsin statutes, relating to the apportionment of public utility taxes. Madison, Wis. 8 p.

Wisconsin Public Service Commission. 1974a. Preliminary environmental report on the proposed unit no. II at the Columbia Generating Station. Bureau of Environmental and Energy Systems, Madison, Wis. Various pagings.

Wisconsin Public Service Commission. 1974 b. Final environmental impact statement on the proposed unit no. II at the Columbia Generating Station. Bureau of Environmental and Energy Systems, Madison, Wis. Various pagings.

Wisconsin Public Service Commission. 1975a. Impacts of power plant siting. Bureau of Environmental and Energy Systems, Madison, Wis. Various pagings.

Wisconsin Public Service Commission. 1975b. Local economic impacts of power plant siting in Wisconsin. Bureau of Environmental and Energy Systems, Madison, Wis. Various pagings.